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SPECTRON D-101 DATASCOPE

Operator's Manual

MP MASTER
MA23767

SPECTRON
D-101 DATASCOPE

OPERATOR'S MANUAL

Revision 3
September 1983

This manual supports
Models D-101A and
D-101X equipped with
Rev 2 Software
or Rev 3 Software

PART NUMBER 4038077-003

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REVISION LEVEL OF THIS BOOK

Revision 2 of the SPECTRON D-101 DATASCOPE OPERATOR'S MANUAL (dated May 1983) supports Models D-101A and D-101X equipped with rev 2 software (D101OS.02.00). This book has been updated to become Revision 3 of the SPECTRON D-101 DATASCOPE OPERATOR'S MANUAL (dated September 1983). The updated manual supports Models D-101A and D-101X equipped with rev 2 software (D101OS.02.00) or rev 3 software (D101OS.03.00).

To effect the update, undated pages were replaced with pages dated September 1983.

Replaced	Added	Deleted
Title/unnumbered	a/b	None
iii/unnumbered	B-3/B-4	
1-1/1-2		
3-1/blank		
4-1/4-2		
5-1/5-2		
A-1/A-2		
B-1/B-2		

In addition, all text or tabular material either changed or added by this revision is highlighted by a vertical line (▮) entered in the page margin. Unchanged material is not thus marked. This is true whether or not it appears in the same place on the revised page as it does on the unrevised page.

DIFFERENCE BETWEEN D101OS.02.00 AND D101OS.03.00

D101OS.03.00 software supports the use of Mass Memory Option Module type 51-114 equipped with D101MM.00.00 software -- D101OS.02.00 software does not. In addition, D101OS.02.00 software requires the use (where appropriate) of Level 1 program editor/compiler PROM type D101ECP.02.00, and D101OS.03.00 software requires the use (where appropriate) of Level 1 editor/compiler PROM type D101ECP.03.00. Otherwise, D-101 operation is the same whether equipped with software type D101OS.02.00 or D101OS.03.00.

SOFTWARE COMPATIBILITY

PROM modules, option modules, and the D-101 itself each contain software. All of these software items are subject to a continuing program of technical improvement and capability enhancement. Consequently, different versions (revisions) of software exist for the same item.

To the greatest degree possible, compatibility is maintained between successive revisions of a given piece of software as well as between a given piece of software and other software items with which it operates. However, certain incompatibilities do exist.

Each new D-101 shipped from the factory is compatible with all PROM modules and option modules (if any) with which it is shipped. As long as the items of a given shipment are used as one system, no incompatibilities will ever arise. However, the physically interchangeable (between D-101s) nature of PROM modules and option

modules may result in incompatibility problems where a user employs the same (physical) PROM modules or option module with different D-101s. The table below is provided to avoid software incompatibility problems that may be experienced by D-101 users with a number of D-101s.

ITEM	D-101 MODEL			
	D-101A-2	D-101X-2	D-101A-3	D-101X-3
	SOFTWARE COMPATIBILITY			
D-101 OS	D101OS.02.00	D101OSX.02.00	D101OS.03.00	D101OSX.03.00
ECP PROM	D101ECP.02.00	D101ECP.02.00	D101ECP.03.00	D101ECP.03.00
BERT PROM	D101BRTO.00.00	D101BRTO.00.00	D101BRTO.00.00	D101BRTO.00.00
PRINT PROM	D101PRTO.01.00	D101PRTO.01.00	D101PRTO.01.00	D101PRTO.01.00
PROMs produced by D-1001 via system disk D1001SD.02.00	See Note	All	See Note	All
MASS MEMORY type 51-114 with D101MM.00.00 software	No	No	D101MM.00.00	D101MM.00.00

Note: All PROMs produced on a D-1001 via system disk D1001SD.02.00 are compatible except those with programs employing the D-101 bit-oriented-protocol facilities.

CONTENTS

Section		Page
1.	INTRODUCTION	1-1
2.	OPERATOR'S SAFETY SUMMARY	2-1
3.	D-101 CONNECTION TO INTERFACE	3-1
4.	PRIMARY OPERATING INSTRUCTIONS	4-1
	A. Power-Up/Confidence Test	4-1
	B. Monitoring Data	4-2
	C. Editing Configuration	4-4
	D. Displaying Lead States	4-9
	E. Running a ROM (Level III) Program	4-10
	F. Displaying the Counters and Timers	4-12
	G. Viewing Page Remarks	4-13
5.	EXTENDED OPERATING INSTRUCTIONS	5-1
	A. Entering a Level I User Program	5-1
	B. Running a Level I User Program	5-4
	C. Loading and Running a Downloaded (Level III) Program	5-6
	D. Changing ROM Program Data Messages	5-8
	E. Transferring Input Buffer Contents or Level I Program Memory Contents	5-10
	F. Printout	5-12
6.	BIT ERROR RATE TEST	6-1
	A. Getting Familiar with BERT	6-1
	B. Operating Procedures for BERT	6-9

APPENDICES

A. USER CONFIDENCE TEST

B. AUTOCONFIGURATION REQUIREMENTS

C. CONFIGURATION TABLE FIELDS

D. DISPLAY DETAILS

E. KEYBOARD FUNCTIONS

F. LEVEL I INSTRUCTION GUIDE

G. TECHNICAL SPECIFICATIONS

H. HEX-ASCII and HEX-EBCDIC CONVERSION CHARTS

I. ERROR MESSAGES

APPENDICES (CONT)

J. D-101 PIN DESIGNATIONS

K. PRINTER INTERFACE

L. GLOSSARY

SUPPLEMENT -- D-101X DECODE/DISPLAY FACILITY FOR BIT-ORIENTED PROTOCOLS

LIST OF ILLUSTRATIONS

Figure		Page
4-1	D-101 Configuration for Monitoring ASCII Async Data @ 1200 BPS Consisting of 7-Bit Characters Plus 1 Parity Bit of Odd Parity and Using 1 Stop Bit	4-6
4-2	D-101 Configuration for Monitoring EBCDIC Bisync Data @ MODEM Speed and with a Sync Pattern of Sy Sy (32 32 Hex)	4-7
4-3	D-101 Configuration for Monitoring SDLC DIP or HDLC DIP Data @ MODEM Speed and with a Sync (and Sync Reset) Pattern of the SDLC Flag (7E Hex)	4-8
5-1	Sample Program	5-3
D-1	Interpretation of Lead State Display	D-3
E-1	Front Panel Keyboard	E-1

LIST OF TABLES

Table		Page
4-1	Configuration Alternatives	4-6
4-2	Configuration Alternatives	4-7
4-3	Configuration Alternatives	4-8
A-1	Self-Test Error Messages	A-2
B-1	Configurations Detected/Established by Autoconfiguration Function of Units Equipped with Rev 2 Software	B-2
B-2	Configurations Detected/Established by Autoconfiguration Function of Units Equipped with Rev 3 Software	B-4
C-1	Configuration Parameters	C-3
E-1	Key Functions in All Modes	E-3
F-1	Level I User Program Instruction Summary	F-7
G-1	Technical Specifications	G-1
I-1	Command Mode/Run Mode Errors	I-3
I-2	Compiler Error Messages	I-5
J-1	D-101 Interface Configurations with Pin Designations	J-2

D-101 DATASCOPE

1. INTRODUCTION

The D-101 is a microprocessor-based test device designed to monitor, display, and interact with both the serial data stream and the control leads of an RS-232C interface. The D-101 may be connected to the data channel in one of three operating states:

- As a passive monitor - the D-101 displays data transactions and control-lead status without affecting online signals. During monitoring, data transactions are stored in memory for subsequent offline review and analysis; alternatively, a program may be used for real-time analysis of these transactions.

- As a modem simulator - the D-101 emulates the interface characteristics of data communication equipment (DCE) and interacts directly with equipment presenting a data-terminal-equipment (DTE) interface (i.e., the D-101 is connected, configured, and programmed to operate in the TO TERMINAL state). During modem-simulator operation, the D-101 not only stores online data in memory (including its own output), but also performs program-controlled analysis and stores the results of the analysis in memory for subsequent review.

- As a terminal simulator - the D-101 emulates the interface characteristics of data terminal equipment (DTE) and interacts directly with equipment presenting a data-communication-equipment (DCE) interface (i.e., the D-101 is connected, configured, and programmed to operate in the TO MODEM state). During terminal-simulator operation, the D-101 (as with modem-simulator operation) not only stores online data in memory, but also performs analysis and stores the results in memory.

Operation of the D-101 as a passive monitor (in RUN MONITOR mode) requires only that the unit be configured for compatibility with the data line to which it is connected (in terms of clock source, baud rate, data format, etc.) Programming is not necessary. A program may, however, be employed when the user wishes to perform real-time analysis of passively monitored data. In this case the D-101 will be operating in the RUN PROGRAM mode.

Configuration is accomplished in one of several ways: (1) by means of an autoconfiguration feature that permits the unit to acquire any one of a group of "standard" configurations automatically, (2) by entering the relevant parameters into a configuration table via the keyboard, or (3) by employing a Level III ROM program module, in which the configuration appropriate to the application is included and automatically loaded along with the program. Note that the D-101 must be connected for monitoring while it is acquiring configuration automatically (see Section 3). In addition, if your unit is equipped with Rev 3 software, PROM type D101ECP.03.00 must be installed in the socket of the front-panel drawer while configuration is being acquired automatically.

Operation of the D-101 when connected as either a modem simulator or terminal simulator (see Section 3) requires the unit to be loaded with both the appropriate configuration and a program suitable for the application. This can be accomplished by any of the following methods:

(1) By loading a ROM module containing the program and configuration for the desired application (Level III programming). This is a simple method of loading fairly complex or lengthy diagnostic routines. Each module may contain more than one program; a directory on the ROM will list resident programs.

(2) By keying-in the program and editing the configuration, using the front-panel keyboard (Level I programming). A prompt display (when selected) leads the user through all necessary steps, offering only the required relevant parameter choices. This method is suitable for loading simple programs (e.g., trap on a data pattern or generate a poll).

(3) By downloading the program (and configuration) from a connected D-1001 Program Development System.

After configuration and programming have been performed, the D-101 is ready for operation (in RUN PROGRAM mode).

The D-101 is compatible with most forms of data transmission, whether synchronous or asynchronous; it provides a range of baud rate settings from 31 to 19,200 bps. D-101 operating controls take the form of 32 keys on a front-panel keyboard. Sixteen of these keys provide entry of hexadecimal digits 0 through F; the remaining 16 control specific operating functions.

A 160-character CRT provides a display of online data appearing on the send data (SD) or receive data (RD) line(s) of the interfacing data channel. The latest 8192 characters of traffic are stored in a data buffer, permitting a user to review this data by scrolling the display backward or forward. The CRT also provides the human interface for D-101 control applications. It always shows the current operating mode, as well as prompts (when appropriate) to guide the operator. The CRT will, in addition, display the logical state of eleven specific leads plus one selectable lead of the RS-232 interface.

A ROM socket located in a drawer in the front panel receives the appropriate ROM to (1) permit the user to key in a program via the front panel keyboard of (2) load a previously developed (canned) user application program (including the appropriate configuration). Note that editor/compiler PROM type D101ECP.02.00 must be used for a D-101 equipped with rev 2 software (displays D101A-2 or D101X-2 on power up), and editor/compiler PROM type D101ECP.03.00 must be used for a D-101 equipped with rev 3 software (displays D101A-3 or D101X-3 on power up).

The D-101 is equipped with a self-test feature known as the System Confidence Test. It automatically tests essential functions of the D-101 and also provides a display that identifies the revision level (rev) of the operating system software installed in the unit. The test program is activated each time the unit is powered up.

All information in the manual, with the exception of the Supplement, applies equally to both the D-101A and D-101X models. As implied by its title, "D-101X DECODE/DISPLAY FACILITY FOR BIT-ORIENTED PROTOCOLS", the Supplement applies only to the D-101X, which alone is equipped with the decode/display capability for bit-oriented protocols. The protocols covered are X.25, X.75, Bisync X.25, SDLC, HDLC, and ADDCP.

2. OPERATOR'S SAFETY SUMMARY

This section highlights safety precautions to be observed when operating or servicing the D-101 DATASCOPE.

GROUNDING

The D-101 is grounded through the grounding conductor of the power cord. Always plug the D-101 into a properly wired receptacle before connecting cables to the unit's DB-25 connectors. Use only the power cord specified for the D-101.

POWER SOURCE

The D-101 operates with power-line voltages commonly expressed as 100, 120, or 240 VAC ± 10% at a frequency of 50-60 Hz ± 10%

These three voltages are actually dealt with by the D-101 in two voltage ranges designated 120 VAC and 240 VAC. The voltage range is factory set (via an internal switch) per customer order. The switch setting is indicated by a rear-panel label (to the left of the fuseholder) applied when the switch is set. The actual tolerance of the D-101 to power-line variation is specified as follows:

Rear Panel Marking) (and Internal-Switch Setting)	Voltage Tolerance	Frequency Tolerance
120 VAC	90-138 VAC	47-63 Hz
240 VAC	184-276 VAC	47-63 Hz

Changing the operating-voltage range of the D-101 is described in the "D-101 Datascope Maintenance Manual" (part number 4038085-001).

FUSE

Use only a fuse of correct type, current rating, and voltage rating as specified below:

100-volt operation - 2 amp/250-volt (normal blow)
120-volt operation - 2 amp/250-volt (normal blow)
240-volt operation - 1 amp/250-volt (normal blow)

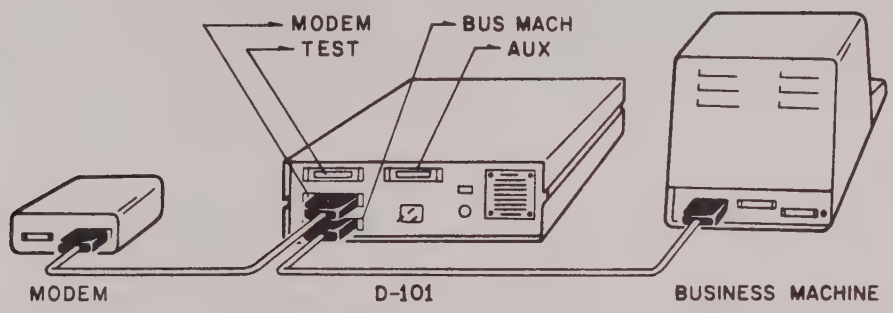
WARNING

DATASCOPE Model D-101 is equipped with a very efficient high-frequency switching power supply. This supply will retain a high voltage charge for approximately 5 minutes after disconnection from the AC input source. Exercise extreme caution when the unit cover is removed for any reason.

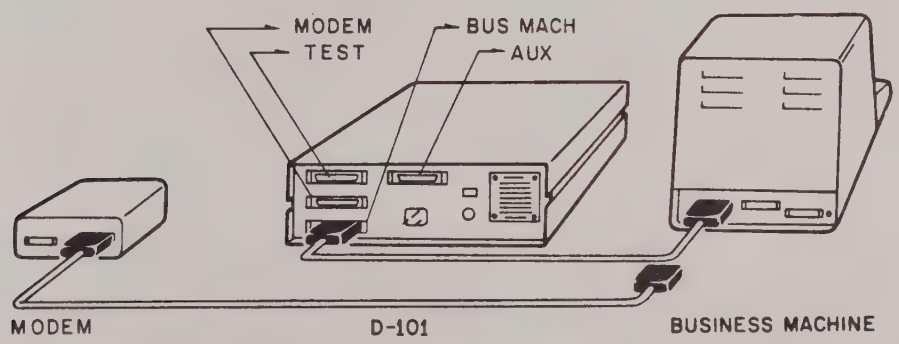
3. D-101 CONNECTION TO INTERFACE

Depending upon the functions it is to perform, the D-101 must be connected to the RS-232 interface in one of three basic setups:

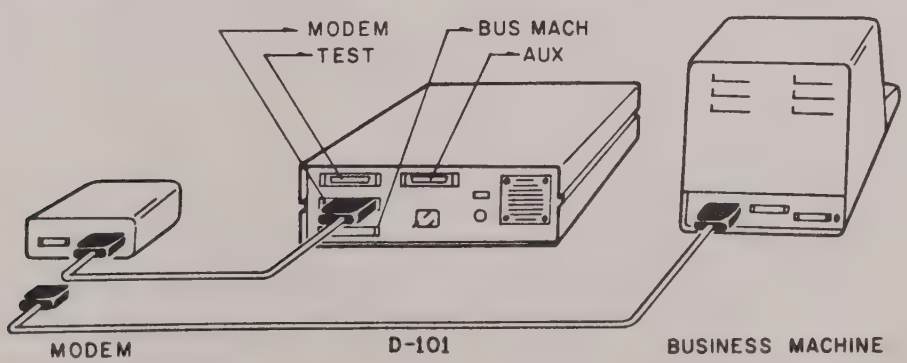
1 For passive monitoring/analysis of the data channel



2 For simulation of a DCE (Data Communication Equipment) having a modem-like interface (to the data line)



3 For simulation of a DTE (Data Terminal Equipment) having a terminal-like interface (to the data line)



Notes: (1) For autoconfiguration, the D-101 must be connected for monitoring, as shown in setup 1. In additon, if your unit is equipped with Rev 3 software, PROM type D101ECP.03.00 must be installed in the socket of the front-panel drawer while configuration is being acquired automatically.

(2) For any of the three setups, the existing data cable may be disconnected at either the modem end or the business machine end, as most convenient.

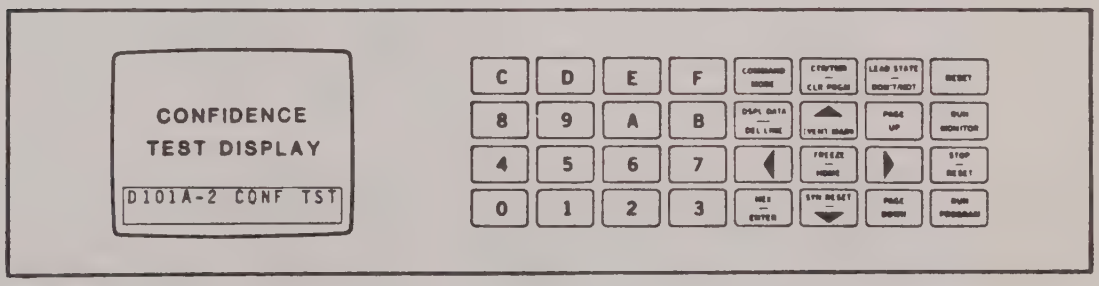
4. PRIMARY OPERATING INSTRUCTIONS

In all procedural steps of Section 4, the key required for a specific step is the one shown heavily outlined on the otherwise blank keyboard illustration. The resulting CRT display appears on the same illustration. Other labeled keys, shown in normal outline, are effective in the currently invoked mode (i.e., the mode identified at the bottom of the display). (Refer to Appendix E for the exact function of each key in every applicable mode.) Where it is impracticable to reproduce the actual CRT display, the CRT illustration identifies the appropriate display in larger type; for example "CONFIDENCE TEST DISPLAY" as shown below.

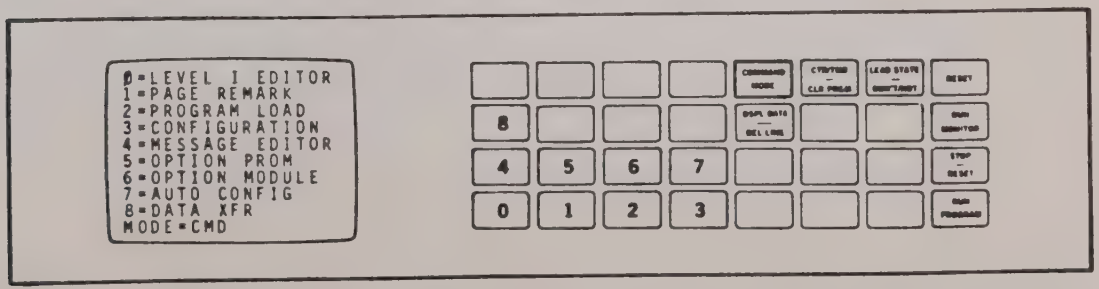
A. POWER-UP/CONFIDENCE TEST

1 After the appropriate interface connection has been made (Section 3), the D-101 is ready for power-up. The power ON/OFF switch is located on the rear panel just above the fuse.

2 When the D-101 is powered up, the confidence test starts automatically. This test checks the system ROMs, the RAM memory, the CRT, and if desired, the front panel. For details of this test and interpretation of any error codes, see Appendix A. Assuming no errors are encountered, the confidence test will, after a few seconds, come to a display, the lower part of which reads "D101A-2 CONF TST" as shown below or "D101X-2 CONF TST". Note that the "A-2" appended to "D101" indicates that standard rev 2 operating system software is installed in the unit and that "X-2" indicates that X.25 (bit-oriented protocol) rev 2 operating system software is installed. The rev 3 operating system software invokes a display of A-3 (instead of A-2) and X-3 (instead of X-2).

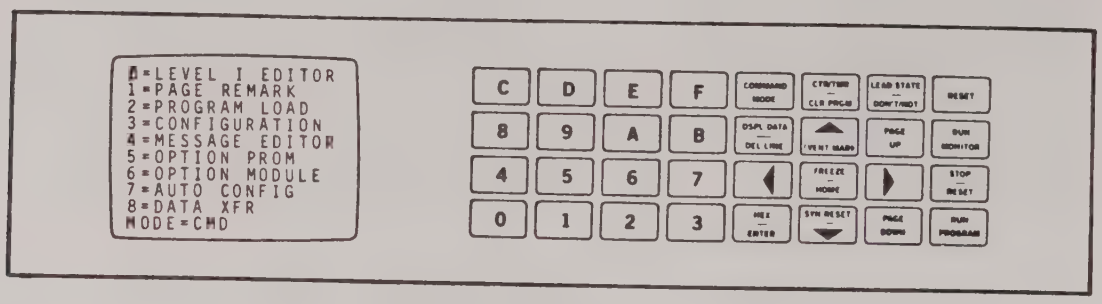


3 Press the COMMAND MODE key to halt the confidence test and put the unit in an operating state; the display shown below will appear. Command Mode is the starting point for all functions of the unit, and it must be selected when switching from one mode to another. For example, after editing the configuration table, Command mode must be selected before another mode (such as Run Monitor) can be selected.



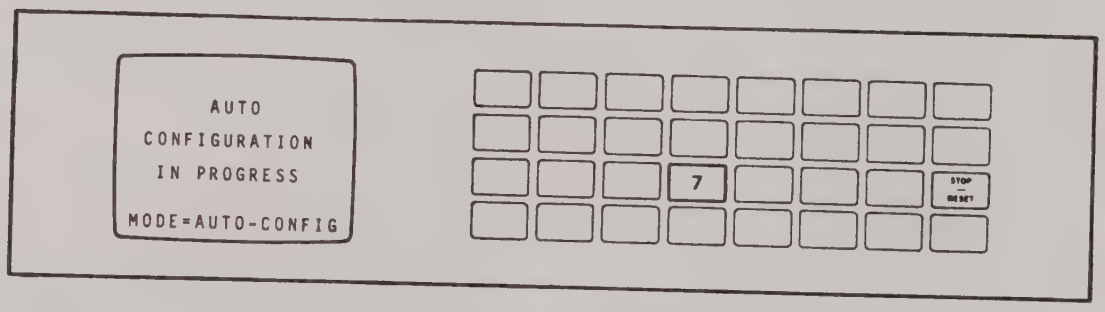
B. MONITORING DATA

1 Start with the D-101 operating in the Command mode (with menu display) as shown below.

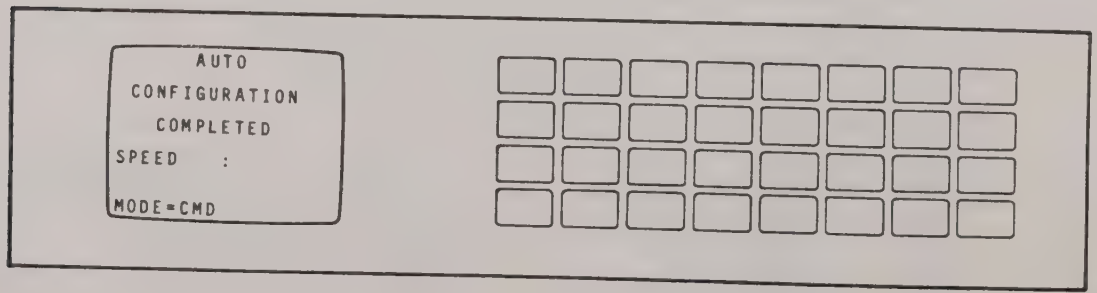


2 Connect the D-101 into the data circuit as shown in Setup 1 of Section 3. In addition, if your unit is equipped with Rev 3 software, PROM type D101ECP.03.00 must be installed in the socket of the front-panel drawer while configuration is being acquired automatically.

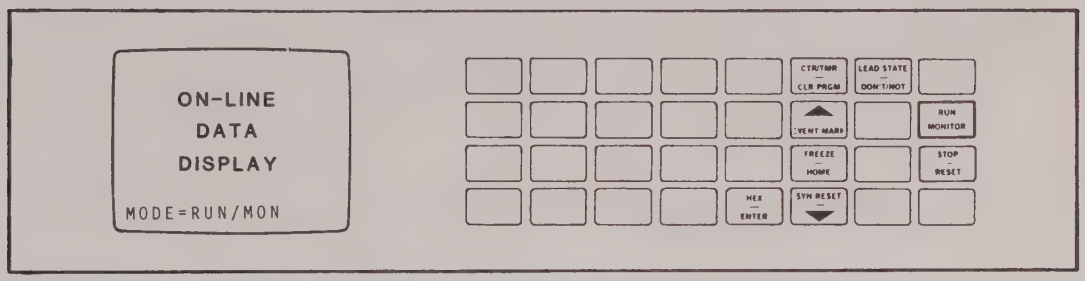
3 Press the 7 key (to establish the automatic configuration mode) and observe the display "MODE=AUTO-CONFIG" while automatic configuration is in progress.



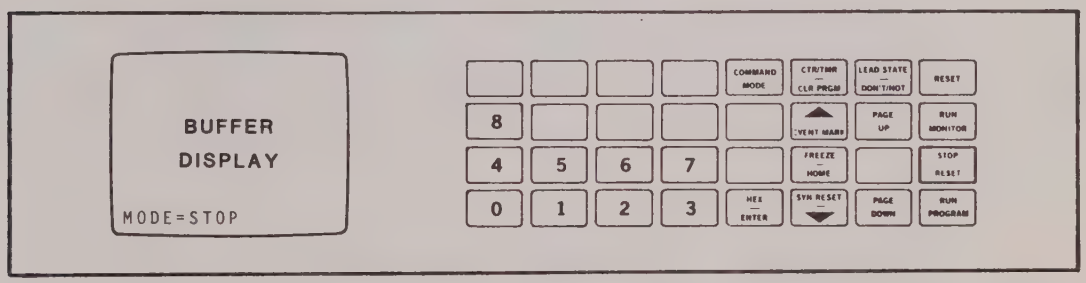
4 When the automatic configuration process is sucessfully completed, the D-101 prompts "CONFIGURATION COMPLETED" and enters the Command mode as shown below. (No key strokes are required.) If a different prompt is displayed, the automatic configuration process was not successful. If this is the case do either of the following before beginning with step 5: (1) refer to Subsection 4C and manually configure, or (2) refer to Appendix B for an explanation of the automatic configuration process and its requirements.



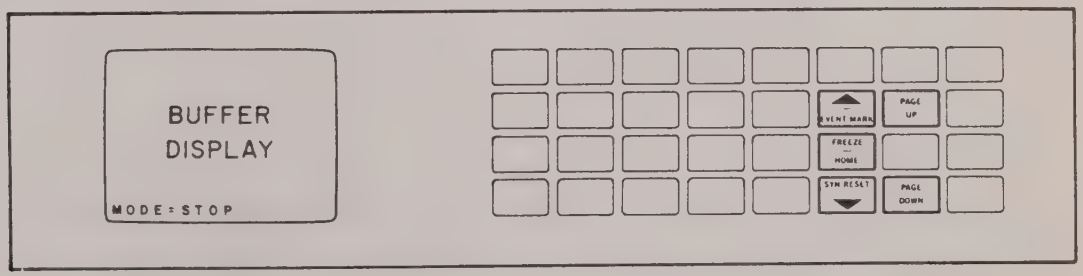
5 Press the RUN MONITOR key (the D-101 enters the Run Monitor Mode), and observe the online data.



6 When online monitoring is completed or when you desire to view the data saved in the input buffer, press the STOP key. The D-101 enters the Stop mode and displays the data most recently read from the data line.



7 In the Stop mode, the group of keys highlighted below are used (as required) to permit examination of the entire input buffer contents.



8 From the Stop mode you can go back to step 5, which clears the input buffer contents and begins monitoring again, or you can return to the Command mode (with menu display) as in step 1 by pressing the COMMAND MODE key.

C. EDITING CONFIGURATION

Editing of the configuration table parameters (clock source, line protocol, etc.) is required under the following circumstances:

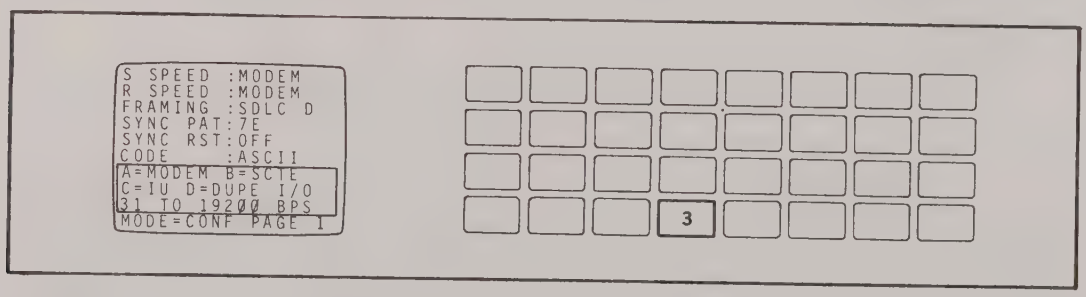
a. When the automatic configuration facility encounters conditions it is unable to handle.

b. When the user is entering a Level I program to be used with a "nonstandard" configuration.

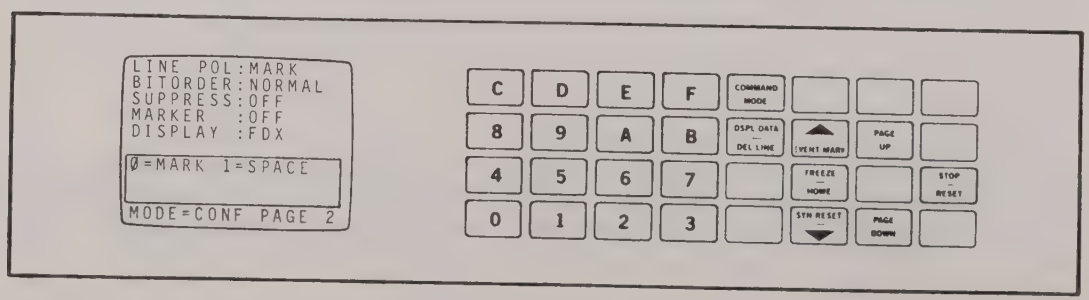
c. When the user wishes to modify the configuration included and automatically loaded with a ROM-based (Level III) program.

A set of parameters is always resident in the configuration table. On power-up a set of widely used parameters is established. This means that as the user edits the configuration he may skip over any parameter that is already correct for his application. The configuration table is displayed on three pages in the D-101A and four pages in the D-101X. Movement within a page is accomplished with the cursor down (▼) and cursor up (▲) keys, and from one page to another with the PAGE DOWN and PAGE UP keys. All legal entries for the field where the cursor is located are displayed as negative video prompts at the bottom of the screen. The editing procedure is summarized below; for more detailed treatment of the subject refer to Appendix C.

1 With the D-101 operating in the Command mode, press the 3 key; page 1 of the configuration table display will appear.



2 Move the cursor to the parameter of interest, using the cursor down, cursor up, PAGE DOWN, PAGE UP, and HOME keys as required.



3 Key in the desired parameter(s) in accordance with the selections offered by the negative-video prompts.

Figures 4-1 through 4-3 show the most commonly used configurations for monitoring ASCII Async, EBCDIC Bisync, and SDLC/HDLC (DIR) data communication. Tables 4-1 through 4-3 provide a wide range of configuration alternatives to permit the D-101 not only to monitor a data line but also to simulate data terminal equipment (DTE), or to simulate data communication equipment (DCE). The footnotes following this paragraph apply to the tables as indicated by the circled letters and numerals.

Footnotes for Tables 4-1 through 4-3

A D-101 functions as a monitor - data line is unaffected by D-101 when either:

(1) It is operated in Run Monitor mode or
(2) It is operated in Run Program mode with a user program that contains no OUTPUT instructions.

B D-101 functions as a DTE simulator - data line is affected by D-101 when both of the following conditions exist:

(1) The OUTPUT configuration table parameter is set to TO MODEM.
(2) The D-101 is operating in the Run Program mode and is executing a user program that contains at least one output instruction. Note that the D-101 will function as a DTE simulator whether or not the OUTPUT instruction(s) are actually executed.

C D-101 functions as a DCE simulator - data line is affected by D-101 when both of the following conditions exist:

(1) The OUTPUT configuration table parameter is set to TO TERMINAL.
(2) The D-101 is operating in the Run Program mode and is executing a user program that contains at least one output instruction. Note that the D-101 will function as a DTE simulator whether or not the OUTPUT instruction(s) are actually executed.

1 Any setting is acceptable. Parameter is irrelevant to this configuration.

2 Set to a decimal value equal to the baud rate of the data line. Range is 31-19200 (bps). 1200 and 2400 are common (widely used) values.

3 200 (ms) is a common (widely used) value. If needed by your system, any value of CTS delay from 1-255 (ms) can be entered.

4 Determine parity type (ODD, EVEN, NONE) and number of stop bits (1,2) employed by the protocol in use on the data line of interest. Set FRAMING appropriately.

5 Determine SDLC/HDLC mode (DIR, or NRZI) employed by the protocol in use on the data line of interest. Set LINE POL appropriately. MARK is standard for SDLC D; SPACE is standard for SDLC N.

6 Choice is optional. Suggested choice is shown in table.

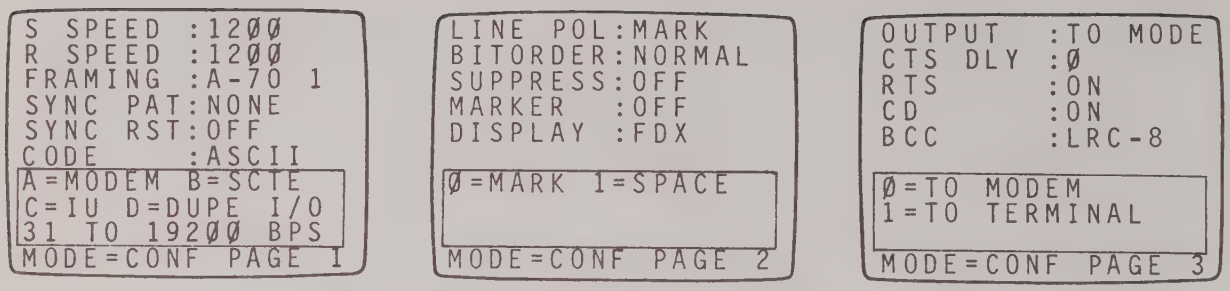


Figure 4-1. D-101 Configuration for Monitoring ASCII Async Data @ 1200 BPS Consisting of 7-Bit Characters Plus 1 Bit of Odd Parity and Using 1 Stop Bit

TABLE 4-1. CONFIGURATION ALTERNATIVES

ASCII ASYNC (7-BIT CHARACTER CODE)			
CONFIGURATION PARAMETER	D-101 FUNCTION		
	MONITOR Ⓐ	SIMULATE DTE Ⓑ	SIMULATE DCE Ⓒ
S SPEED	②	②	②
R SPEED	②	②	②
FRAMING	A-70 1 ④	A-70 1 ④	A-70 1 ④
SYNC PAT	NONE	NONE	NONE
SYNC RST	OFF	OFF	OFF
CODE	ASCII	ASCII	ASCII
LINE POL	MARK	MARK	MARK
BITORDER	NORMAL	NORMAL	NORMAL
SUPPRESS	OFF	OFF	OFF
MARKER	OFF	OFF	OFF
DISPLAY	FDX ⑥	FDX ⑥	FDX ⑥
OUTPUT	①	TO MODE	TO TERM
CTS DLY	①	0	0
RTS	①	SW	ON
CD	①	ON	ON
BCC	①	LRC-8	LRC-8

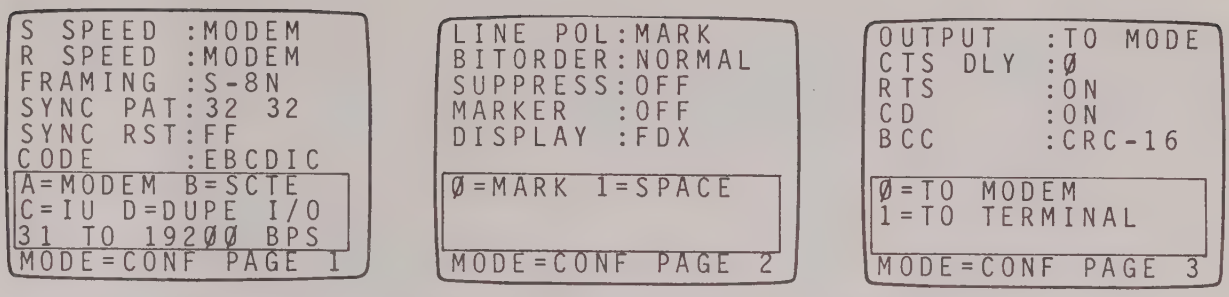


Figure 4-2. D-101 Configuration for Monitoring EBCDIC Bisync Data @ MODEM Speed and with a Sync Pattern of Sy Sy (32 32 Hex)

TABLE 4-2. CONFIGURATION ALTERNATIVES

EBCDIC BISYNC			
CONFIGURATION PARAMETER	D-101 FUNCTION		
	MONITOR (A)	SIMULATE DTE (B)	SIMULATE DCE (C)
S SPEED	MODEM	MODEM	(2)
R SPEED	MODEM	MODEM	(2)
FRAMING	S-8N	S-8N	S-8N
SYNC PAT	32 32	32 32	32 32
SYNC RST	FF	FF	FF
CODE	EBCDIC	EBCDIC	EBCDIC
LINE POL	MARK	MARK	MARK
BITORDER	NORMAL	NORMAL	NORMAL
SUPPRESS	OFF	OFF	OFF
MARKER	OFF (6)	OFF (6)	OFF (6)
DISPLAY	FDX (6)	FDX (6)	FDX (6)
OUTPUT	(1)	TO MODE	TO TERM
CTS DLY	(1)	Ø	200 (3)
RTS	(1)	SW	ON
CD	(1)	ON	ON
BCC	(1)	CRC-16	CRC-16

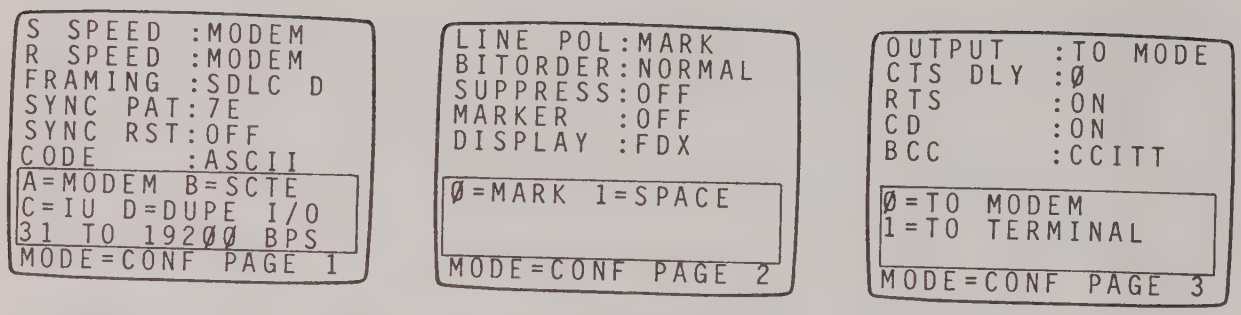


Figure 4-3. D-101 Configuration for Monitoring SDLC DIR or HDLC DIR Data @ MODEM Speed and with a Sync (and Sync Reset) Pattern of the SDLC Flag (7E Hex)

TABLE 4-3. CONFIGURATION ALTERNATIVES

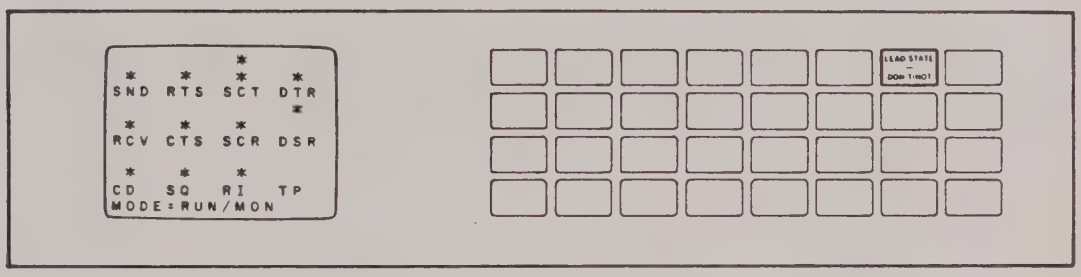
SDLC/HDLC (DIR or NRZI)			
CONFIGURATION PARAMETER	D-101 FUNCTION		
	MONITOR (A)	SIMULATE DTE (B)	SIMULATE DCE (C)
S SPEED	MODEM	MODEM	(2)
R SPEED	MODEM	MODEM	(2)
FRAMING	SDLC D (5)	SDLC D (5)	SDLC D (5)
SYNC PAT	7E	7E	7E
SYNC RST	OFF	OFF	OFF
CODE	ASCII	ASCII	ASCII
LINE POL	(5)	(5)	(5)
BITORDER	NORMAL	NORMAL	NORMAL
SUPPRESS	OFF	OFF	OFF
MARKER	OFF	OFF	OFF
DISPLAY	FDX (6)	FDX (6)	FDX (6)
OUTPUT	(1)	TO MODE	TO TERM
CTS DLY	(1)	0	200 (3)
RTS	(1)	SW	ON
CD	(1)	ON	ON
BCC	(1)	CCITT	CCITT

D. DISPLAYING LEAD STATES

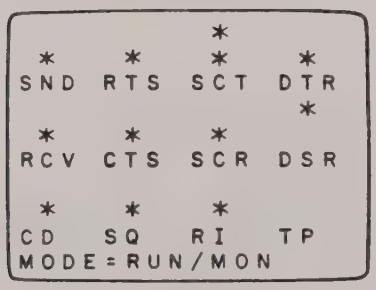
1 The D-101 will, upon request, produce a CRT display that shows the logical state of signals appearing on the D-101-to-data-line interface. Known as the LEAD STATE DISPLAY, this facility can be invoked when the CRT indicates the D-101 is operating in any of the following modes:

MODE=CMD
MODE=RUN/MON
MODE=RUN/PROG
MODE=STOP

2 To invoke the lead state display, press the LEAD STATE key.



Note: The CRT illustration below is provided as an aid in interpreting the display; it does not represent a typical set of logical conditions. For more detailed information refer to Appendix D, Section 2.



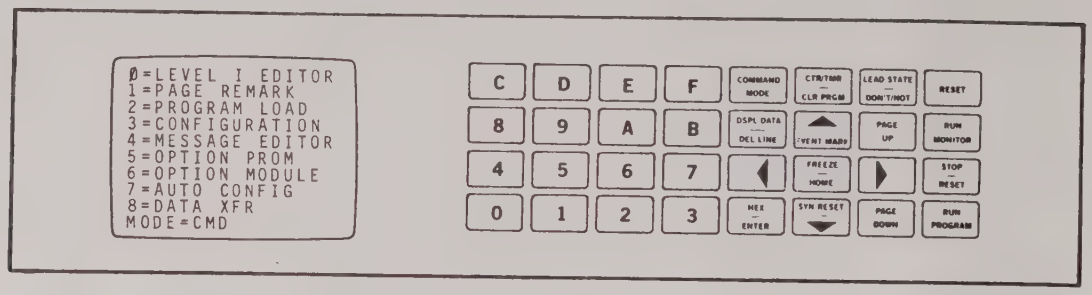
INTERPRETATION

DSR = EIA HIGH
SCT = CONTINUING RAPID TRANSITIONS
TP = NOT IN USE (AUX CONNECTOR PIN 11 ACCEPTS TP INPUT)
ALL OTHERS = EIA LOW

3 To return to the previous display, press the LEAD STATE key again.

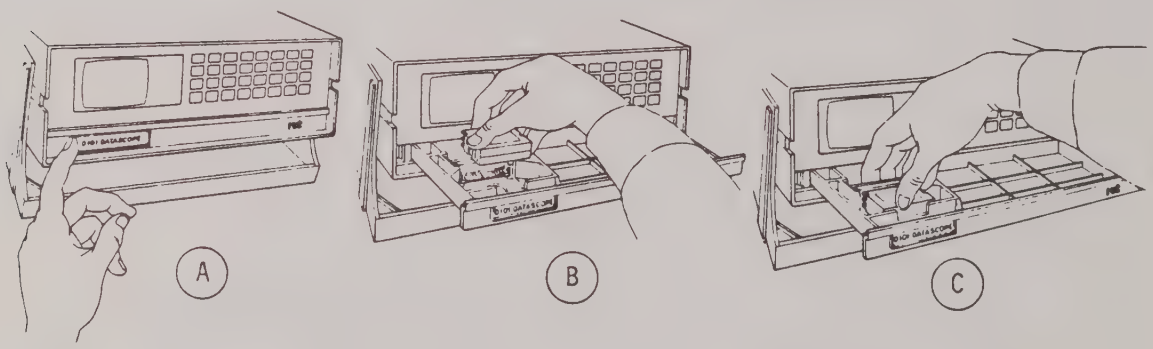
E. RUNNING A ROM (LEVEL III) PROGRAM

1 Start with the D-101 in the Command mode (and showing menu display). This condition is illustrated below.



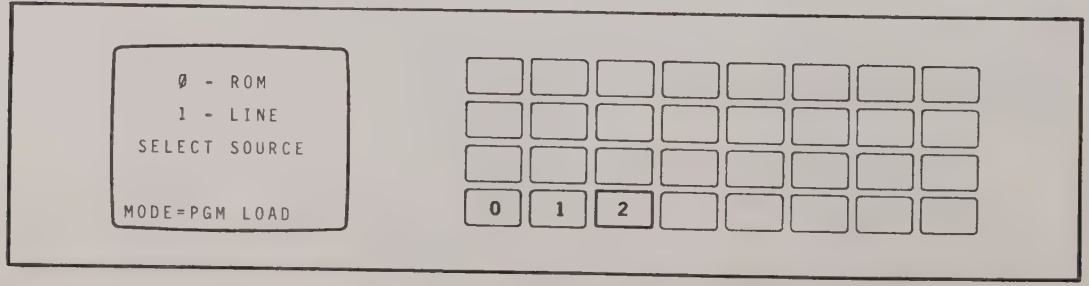
2 Determine which D-101-to-data-line connection is required for the program you intend to load and run.

3 Install the selected ROM module in the D-101. (A, B, and C below) and close the drawer.

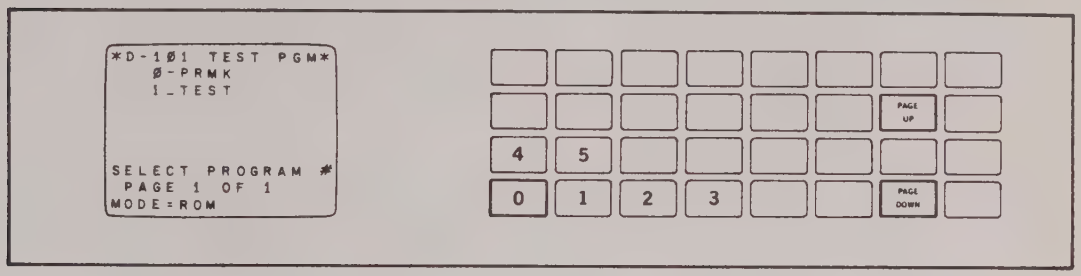


4 Verify that the D-101 is connected to the data line as required for the program to be run. Section 3 illustrates the valid connection alternatives.

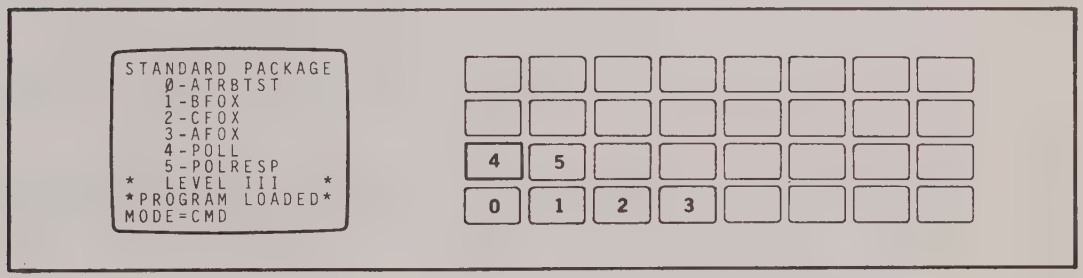
5 Press key 2 to enable the load-from-ROM-module process, and observe the "program load" display.



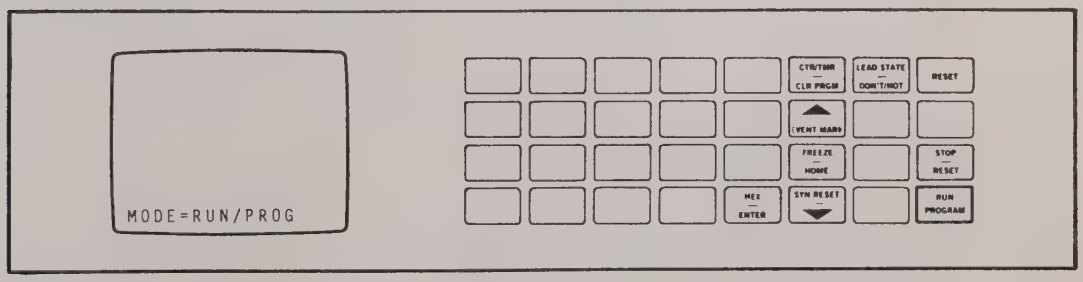
6 Press the 0 key to display the ROM module directory. Multiple-page directories are viewed with the aid of the PAGE UP and PAGE DOWN keys. (The illustration shows page 1 of the two-page directory read from the "Standard PROM" supplied with the D-101.



7 Referring to the directory display, press the key with same number as the desired program. When the key is pressed the CRT reports PROGRAM LOADED, and the D-101 returns to the Command mode regardless of which program (number) you select. In the illustration below, program 4 (POLL) was selected.



8 Press the RUN PROGRAM key; program operation begins as described in the documentation associated with the ROM module.

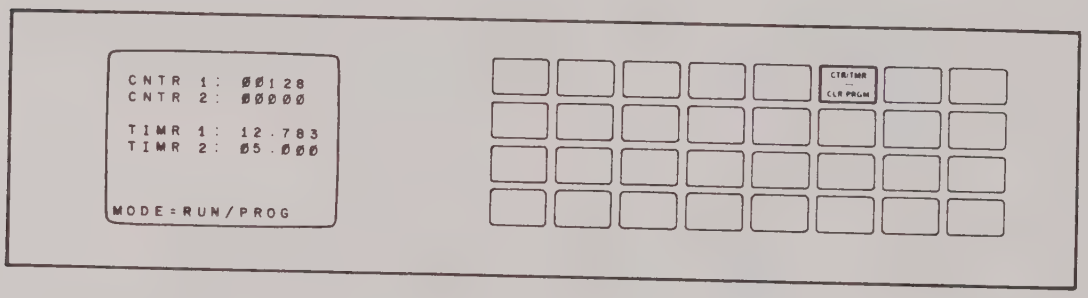


F. DISPLAYING THE COUNTERS AND TIMERS

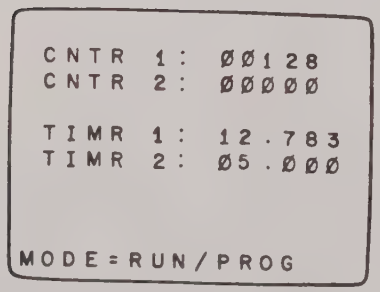
1 The D-101 will upon request, produce a CRT display that shows the current values held by timers and counters. Known as the COUNTER/TIMER DISPLAY, this facility can be invoked when the CRT indicates the D-101 is operating in any of the following modes:

MODE=CMD
MODE=RUN/MON
MODE=RUN/PROG
MODE=STOP

2 To view the counter/timer display, press the CTR/TMR key. The CRT immediately presents the current values of both timers and both counters. These values are not updated continuously on the CRT; they represent a snapshot of values, taken each time the mode is entered.



Note: The CRT illustration below is provided as an aid in interpreting the display. For more detailed information refer to Appendix D, Section 3.



INTERPRETATION

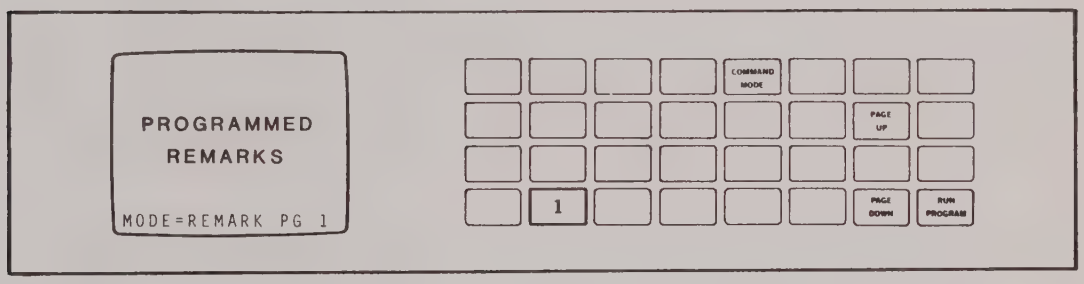
COUNTER 1 = 128 COUNTS
COUNTER 2 = 0 COUNTS
TIMER 1 = 12.783 SECONDS
TIMER 2 = 5 SECONDS

3 To return to the previous display, press the CTR/TMR key again.

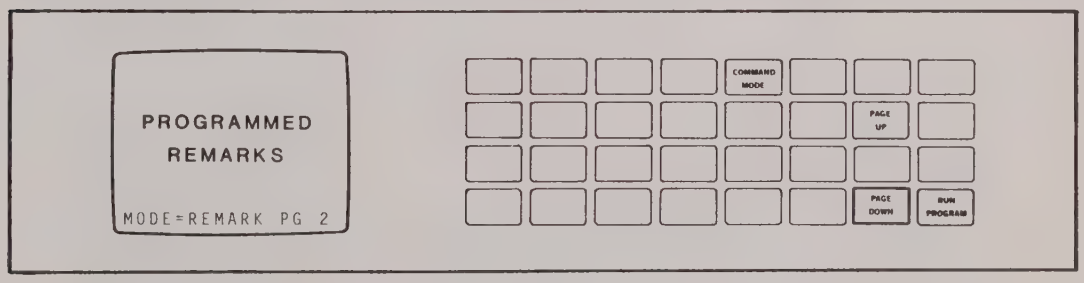
G. VIEWING PAGE REMARKS

1 The page remarks feature applies only to ROM-based (Level III) user programs. The basic function of the feature is to accumulate information, during the running of the program, that can be automatically displayed as "page remarks" during program execution or that can be manually called up for display when the program terminates. The user has control of the display of remarks only after program termination. Their accumulation is as dictated by the Level III program.

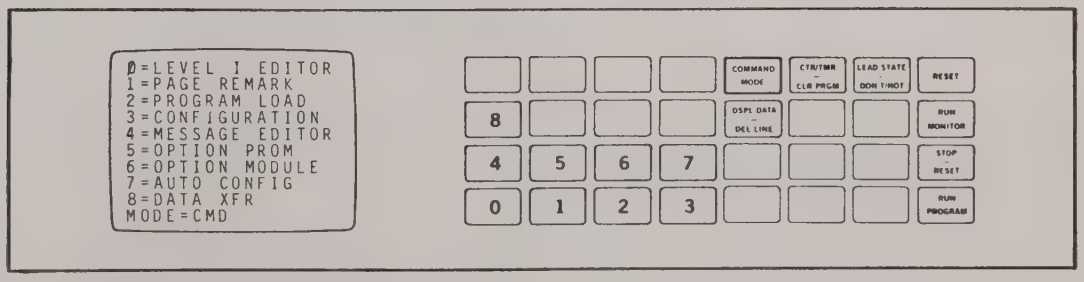
2 When the user program (employing page remarks) terminates (CRT displays MODE=STOP) press the 1 key to view page 1 of the remarks .



3 Press the PAGE DOWN key to view page 2 of the remarks.



4 Press the COMMAND MODE key to exit the page remarks feature and return to Command mode.



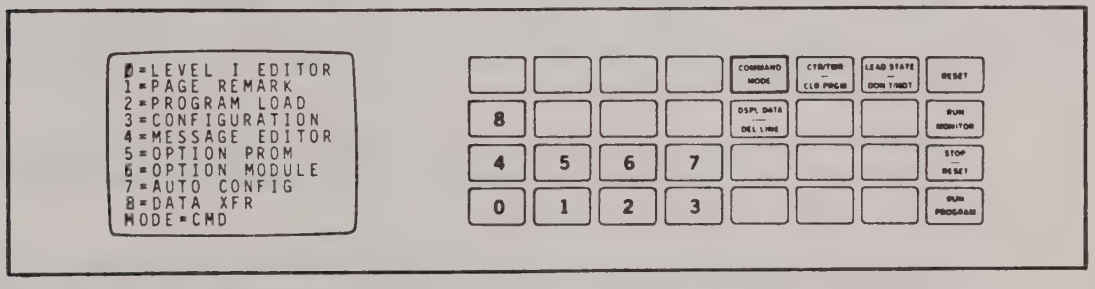
5. EXTENDED OPERATING INSTRUCTIONS

In all procedural steps of Section 5, the key required for a specific step is the one shown heavily outlined on the otherwise blank keyboard illustration. The resulting CRT display appears on the same illustration. Other labeled keys, shown in normal outline, are effective in the currently invoked mode (i.e., the mode identified at the bottom of the display). (Refer to Appendix E for the exact function of each key in every applicable mode.) Where it is impracticable to reproduce the actual CRT display, the CRT illustration identifies the appropriate display in larger type; for example "BUFFER DISPLAY" (as shown in Section 5.B.3).

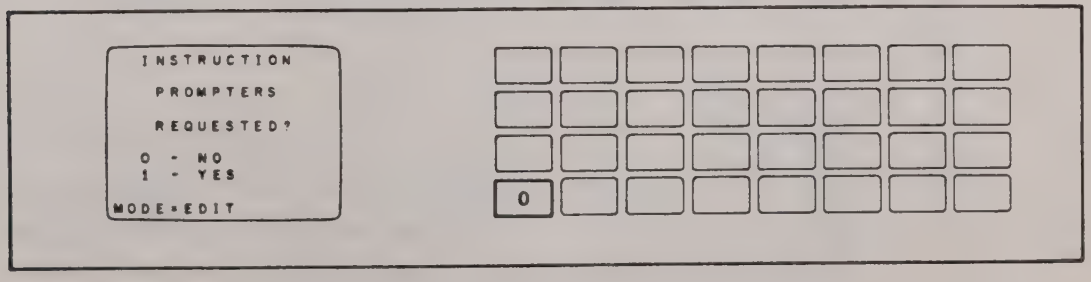
A. ENTERING A LEVEL I USER PROGRAM

This section describes the procedure for entering a previously written Level I user program. It employs a sample program (Figure 5-1) to illustrate the steps involved in entering specific program instructions. The program shown is designed to issue an EBCDIC Bisync general poll once every second. For detailed procedures for writing a Level I program refer to Appendix F - Level I Programming Guide. The basic entry procedure is summarized below.

1 Begin with the "LEVEL I, D-101 ECP (Editor/Compiler) ROM module installed and with the D-101 operating in the Command mode and displaying the menu (as illustrated). Note that editor/compiler PROM type D101ECP.02.00 must be used for a D-101 equipped with rev 2 software (displays D101A-2 or D101X-2 on power up), and editor/compiler PROM type D101ECP.03.00 must be used for a D-101 equipped with rev 3 software (displays D101A-3 or D101X-3 on power up).

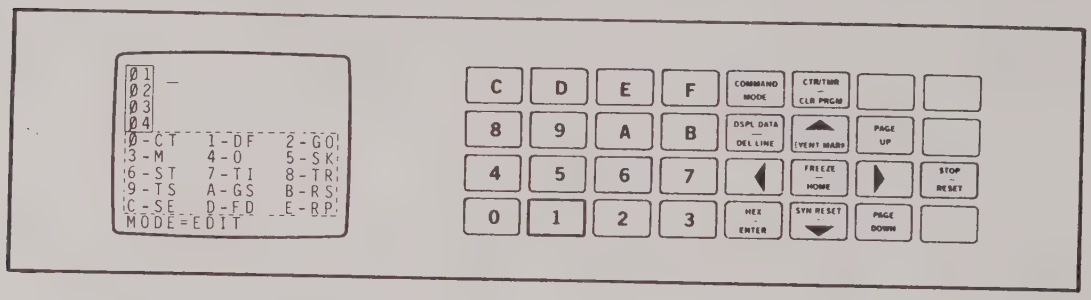


2 Press the 0 key (to invoke edit mode and enable the selection or rejection of prompts with the program listing).



3 Press the 1 key, to display a program listing with prompts.

Note: This description assumes use of the listing with prompts (as illustrated below). As a user becomes familiar with the program listing process, he may elect to use the listing without prompts, which doubles the number of instruction lines displayed on one screen.



4 If the program listing is blank (as shown above), proceed to step 6.

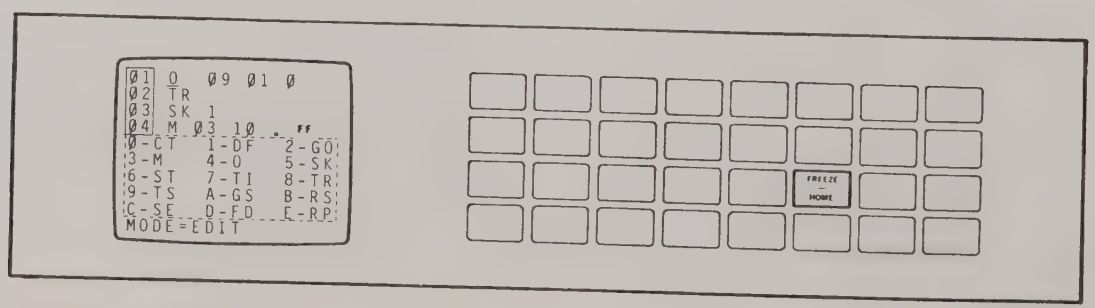
5 If the listing contains unwanted instructions of a previously entered program, either: (a) clear program memory, by first pressing the CLR PRGM key and then the 1 key, or (b) clear unwanted lines of the program, by using the cursor down (▼) and cursor up (▲) keys as required to position the cursor on the unwanted line and then pressing the DEL LINE key.

6 Refer to the parameter entry listing of Figure 5-1 and press keys in the order listed in the keystrokes column. When the entry 40901000 has been keyed in, the CRT will display line 01 of the program listing. Note that entries for the Match and Define Field instructions are made using hex-equivalent characters. Refer to Appendix H for Hex-ASCII or Hex-EBCIDC conversion charts, as applicable.

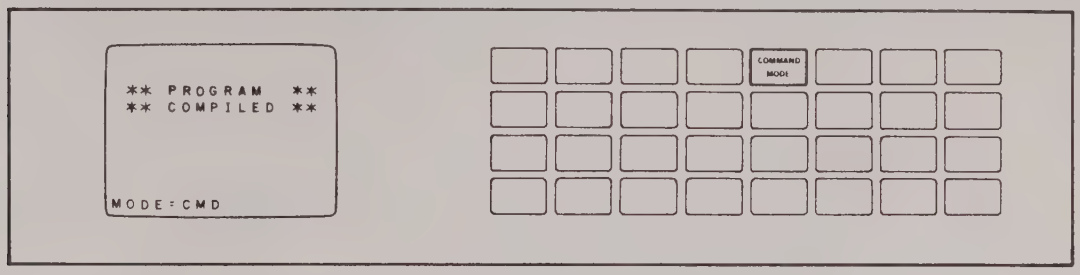
7 Complete the entry of each subsequent program line in the same way; in each case the CRT-displayed prompts will change to prompt appropriately for the parameter to be entered.

8 When all program steps have been entered, review the complete program, using the cursor down (▼) and cursor up (▲) keys and/or the PAGE DOWN and PAGE UP keys as required, to verify that the program, as entered, matches the program listing. Correct any incorrect entries.

9 Press the HOME key (to move the cursor to the beginning of line 01 and to define line 01 as the starting point for program execution).



10 Press the COMMAND MODE key (to compile the program and to return to the Command mode).



11 Verify that the present D-101 configuration matches the configuration specification for the program to be run (Figure 5-1 includes an appropriate configuration for the sample program.) If necessary, edit the configuration (refer to Section 4.C).

12 When the configuration is appropriate for the program, press the COMMAND key, to return to the Command mode and to permit Run Program mode to be invoked (refer to Section 5.B).

	PROGRAM LISTING		PARAMETER ENTRY	
			PROGRAM LINE	KEYSTROKES
	Ø1	0 Ø9 Ø1 ØØ	Ø1	4Ø9Ø1Ø
	Ø2	TR	Ø2	8
	Ø3	SK 1	Ø3	51▼
	Ø4	M Ø3 1Ø .	Ø4	3Ø31Ø DON'T/NOT FF
	Ø5	TI Ø7 1 Ø1ØØØ	Ø5	7Ø71Ø1ØØØ
	Ø6	GO Ø5	Ø6	2Ø5
	Ø7	TI ØØ 1 Ø	Ø7	7ØØ1Ø▼
	Ø8	GO Ø1	Ø8	2Ø1
*	Ø9	DF 32 32 32 32 40 40 7F 7F 2D	Ø9	1323232324Ø4Ø7F7F2D◄ ENTER ▼
**	10	DF 2D	10	12D◄ ENTER ▼ HOME COMMAND MODE

* EBCDIC EQUIVALENT = $_{SY}$ $_{SY}$ $_{SY}$ $_{SY}$ Ø Ø " " $_{EQ}$
** EBCDIC EQUIVALENT = $_{EQ}$

Ø=BLANK SPACE

CONFIGURATION SPECIFICATION	
S SPEED	:12ØØ
R SPEED	:12ØØ
FRAMING	:S-8N
SYNC PAT	:32 32
SYNC RST	:FF
CODE	:EBCDIC
LINE POL	:MARK
BITORDER	:NORMAL
SUPPRESS	:OFF
MARKER	:OFF
DISPLAY	:FDX
OUTPUT	:TO TERM
CTS DLY	:Ø
RTS	:ON
CD	:ON
BCC	:NONE
DECODE	:NONE
ISOL.ADR	:OFF
MK FRAME	:NONE
ISOL.LCN	:OFF
MK PACK	:NONE

Figure 5-1. Sample Program

B. RUNNING A LEVEL I USER PROGRAM

This section describes the procedure for running a Level I user program. Before running this procedure, the following must be done:

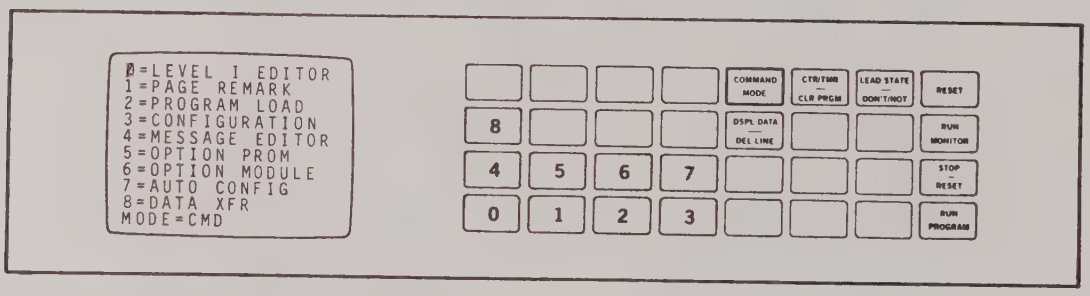
a. The program must be entered (Section 5.A).

b. The appropriate configuration must be entered (Section 4.C).

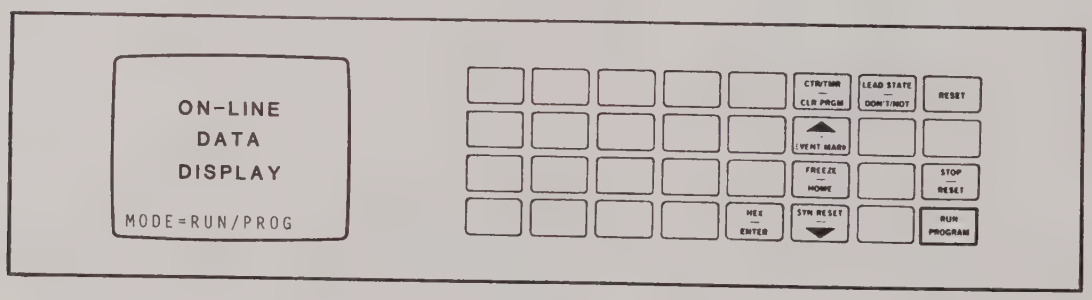
c. The appropriate D-101-to-data-line connection must be made (Section 3).

The basic procedure is summarized below.

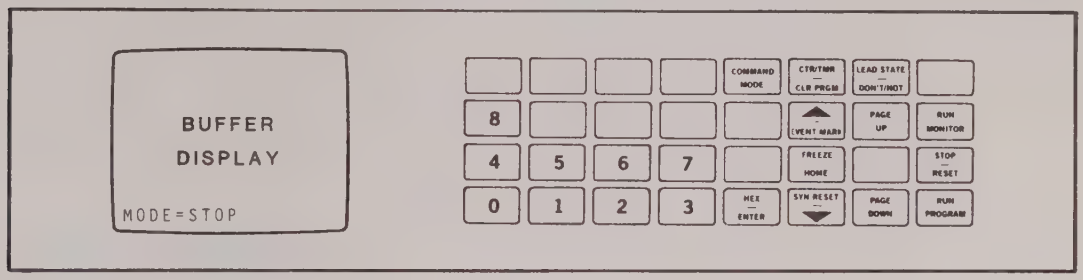
1 Begin with the above conditions satisfied and with the D-101 operating in the Command mode and displaying the menu (as illustrated).



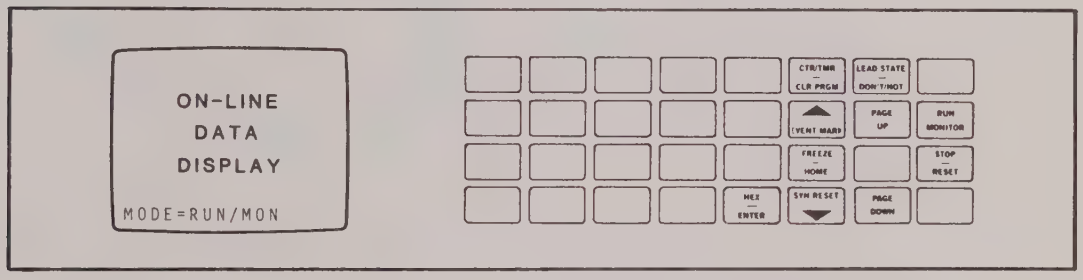
2 Press the RUN PROGRAM key, to begin execution of the user program and to invoke the display of on-line data.



3 When program execution stops (either automatically under program control or by pressing the STOP key when the program objective has been accomplished) the D-101 enters the Stop mode and displays the data most recently read from the data line.



4 In the Stop mode, a group of keys (highlighted below) are enabled, in order to permit examination of the entire input buffer contents.

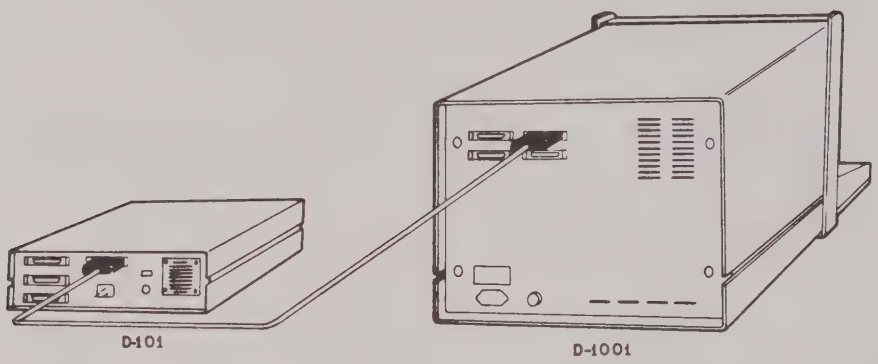


5 From the Stop mode you can go to step 2, to clear the input buffer contents and run the program again, or you can return to the Command mode (with menu display) as in step 1 by pressing the COMMAND MODE key.

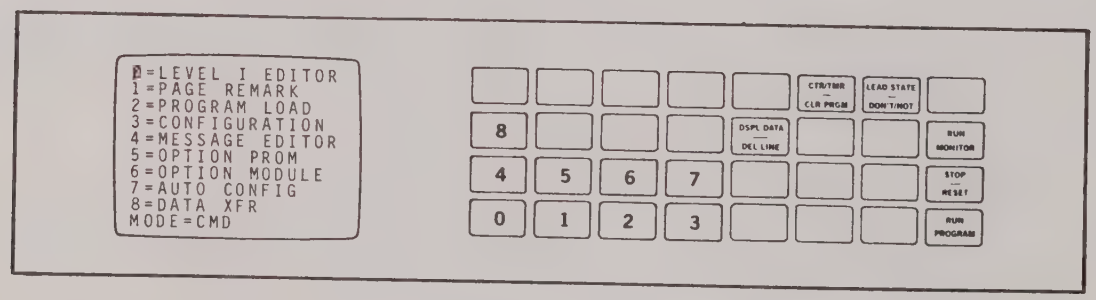
C. LOADING AND RUNNING A DOWNLOADED (LEVEL III) PROGRAM

This section describes the basic procedure for downloading a Level III program from a D-1001 Program Development System and subsequently running it on the D-101. This facility permits testing of a modified or newly written program before committing it to a ROM module. The procedure is described below.

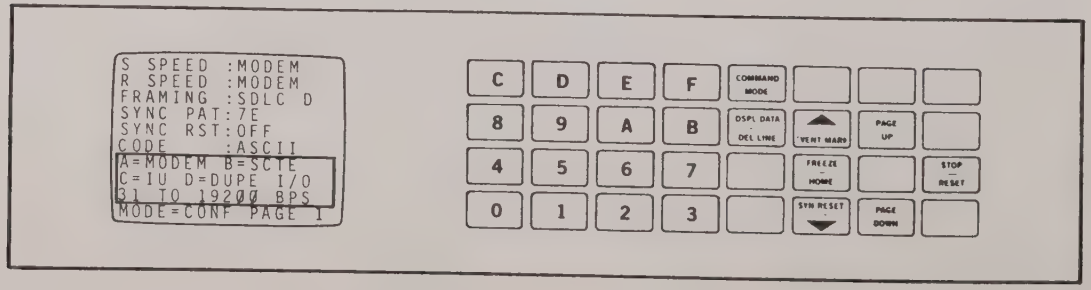
1 Interconnect the D-101 and the D-1001 (with a data cable) as shown below. Also, verify that the D-101 is connected to the data line as required for the program to run. Section 3 illustrates the valid connection alternatives.



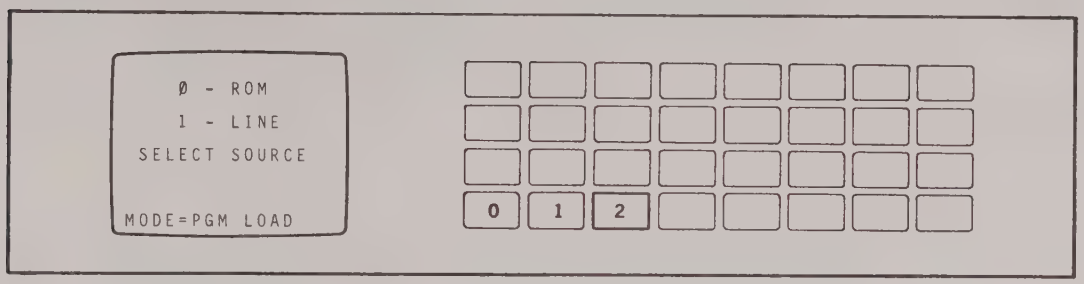
2 On the D-101, establish operation in the Command mode, with the menu displayed, as illustrated below.



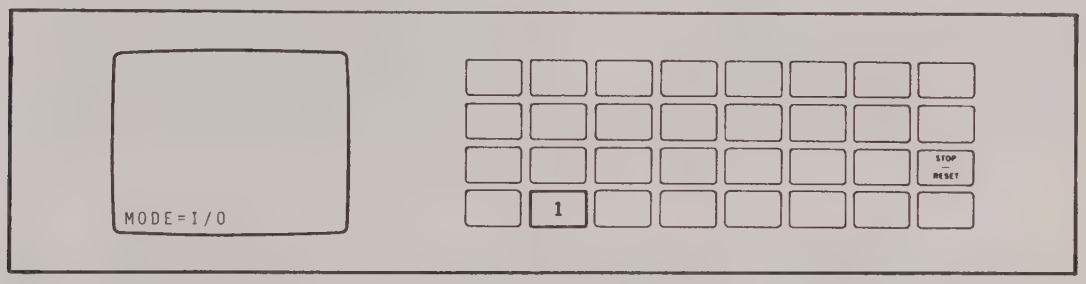
3 Press the 3 key, to invoke the Configuration Edit mode, then use the decimal-digit keys to enter a speed value equal to the I/O channel baud rate of the D-1001. This will enable communication between the D-1001 and the D-101.



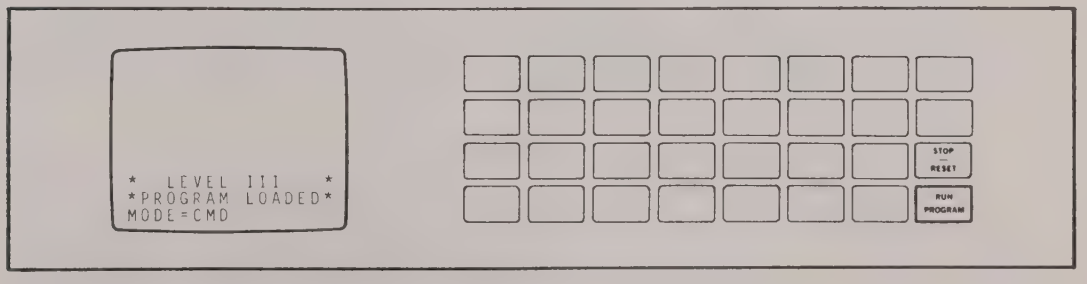
4 Return to Command mode (press COMMAND MODE key) and then press the 2 key to invoke the PGM LOAD mode and permit the selection of program load source (from ROM or from line).



5 Press the 1 key to invoke the I/O mode and thus enable the D-101 to accept a program and configuration (from the D-1001).



6 On the D-1001, output the program and configuration. (The procedure is described in the D-1001 Operation Manual.) Down-loading of data (program or data transfer) into the D-101 is indicated by a blinking asterisk in the lower right-hand corner of the CRT. Upon successful transfer, the D-101 prompts PROGRAM LOADED and returns to the Command mode (as illustrated below). You may then press RUN PROGRAM key, or in the event that the program has failed to load, press the STOP key and return to step 3. (At this point, assuming that the program loaded successfully, D-101 operation is the same whether the program and configuration are loaded from a ROM module or downloaded from the D-1001.)

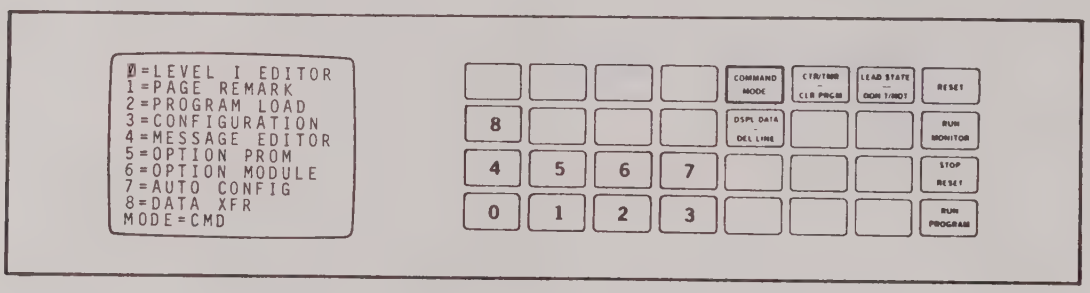


D. CHANGING ROM PROGRAM DATA MESSAGES

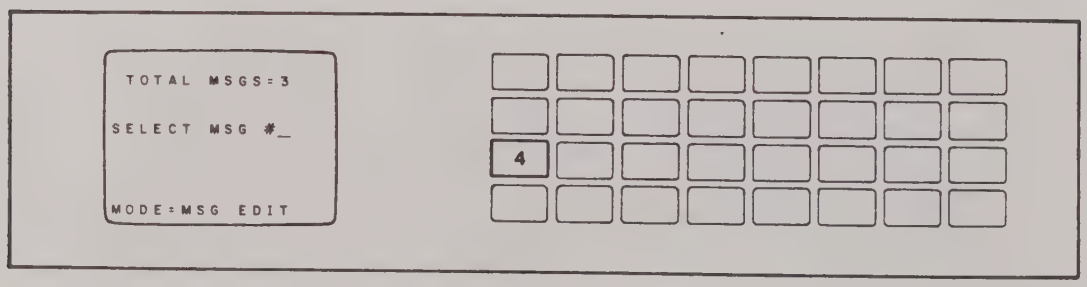
ROM-module (Level III) programs may include data messages that can be changed to adapt a program to specific conditions. For example, a terminal test program can be written in which the terminal address can be changed to match the terminal under test. This section describes the procedure for making such changes. In this procedure it is assumed that a Level III user program (that contains "unprotected" data fields) is presently resident in memory (i.e., one previously loaded from a ROM module or downloaded from a D-1001).

The basic procedure is summarized below.

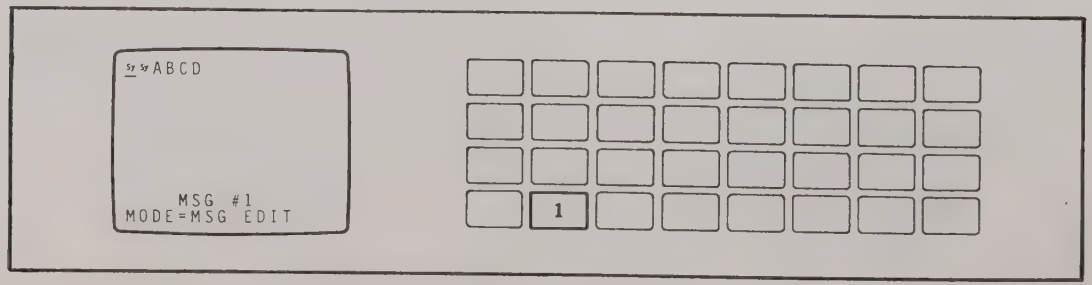
1 Begin with the above conditions satisfied and with the D-101 operating in the Command mode and displaying the menu (as illustrated).



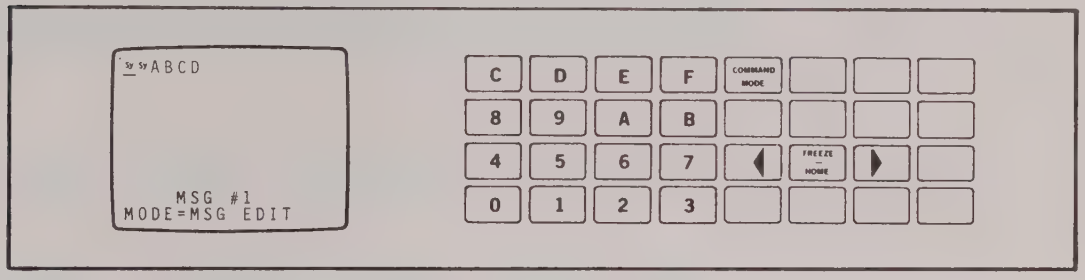
2 Press the 4 key (to invoke the Message Edit mode and enable selection of the message to be edited).



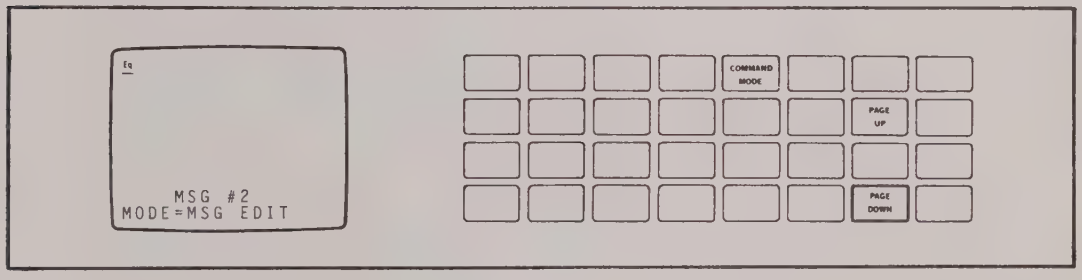
3 Press the key with the same number as the message to be edited, then press the ENTER key (to display the selected message and enable editing of that message). The illustration below shows a sample message (#1) the content of which is Sy Sy ABCD.



4 Use the cursor right (▶) and cursor left (◀) keys as required to position the cursor under the character to be changed. Refer to the Hex-ASCII or Hex-EBCDIC chart (Appendix H) as applicable, and enter the hex equivalent of the desired character. When all desired changes have been made, as described in steps 3 and 4, proceed to step 5. Note that the number of characters in the message is a function of the Level III program; it cannot be changed by this procedure.



5 To view and/or edit another message, use the PAGE DOWN and PAGE UP keys as required to select the desired message. If you want to edit that message follow the directions of step 4. The illustration below shows the result of pressing PAGE DOWN to access sample message #2, the content of which is EQ.



6 When all messages have been viewed and/or edited as desired, press the COMMAND MODE key (to terminate the message edit function and to return to the Command mode menu display as illustrated in step 1).

E. TRANSFERRING INPUT BUFFER CONTENTS OR LEVEL I PROGRAM MEMORY CONTENTS

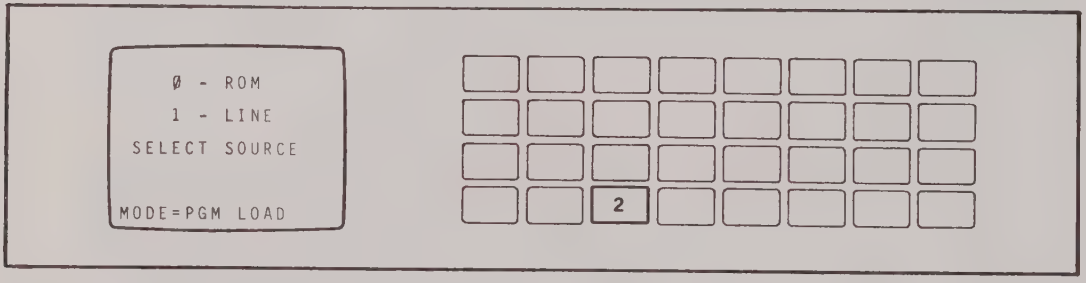
When the AUX ports of two D-101s are suitably connected via a data line, the PROGRAM LOAD and DATA XFR functions can be employed to transfer input buffer contents or Level I program memory contents from one D-101 to another.

The AUX ports must be connected via either: (1) a special modem-eliminator-type cable (Spectron Marketing P/N 75-183), or (2) asynchronous modems and ordinary data cables.

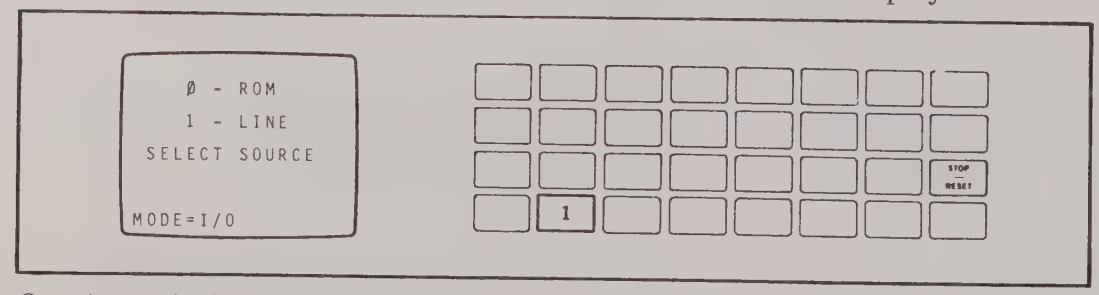
In addition, the S SPEED and R SPEED parameters of both D-101s (configuration table page 1) must be set to the same speed (of your choice); however, if modems are used, the choice of speed must be compatible with the modems and data line you intend to use.

After satisfying all of the above conditions, and with both D-101s operating in Command mode, with menu display, proceed as follows:

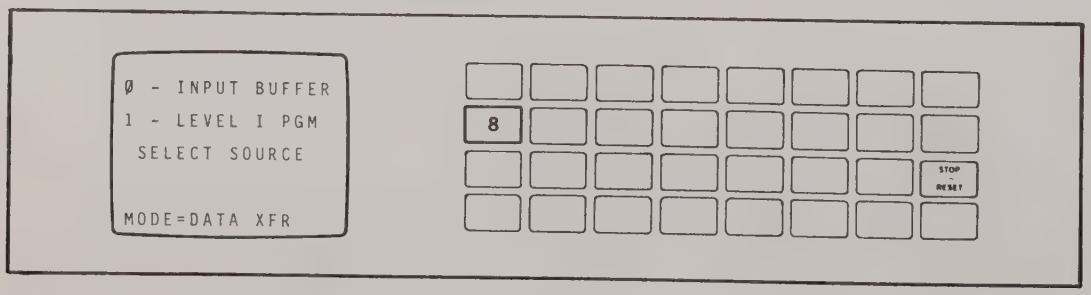
1 On the unit intended to receive the data, press the 2 key and observe the PGM LOAD display.



2 On the same unit, press the 1 key and observe the I/O display.



3 On the unit intended to transmit the data, press the 8 key and observe the DATA XFR display.



4 On the same unit, press either: (1) the 0 key to transfer the input buffer contents, or (2) the 1 key to transfer Level I program memory contents. Observe a blinking asterisk (*) in the lower right corner of the CRT display of both units as the transfer proceeds, and observe that both units report "XFR COMPLETE" and return to command mode when the transfer is successfully completed.

5 On both units, press the COMMAND MODE key to return to the menu display (of Command mode) in preparation for the next operation.

F. PRINTOUT

The programmed contents of a PRINT option PROM enable the D-101 to output (via the AUX port) various types of "in memory" information to a suitable printer. This facility selectively produces hardcopy (printout) of the following items:

(1) Input buffer contents
(2) Counter/timer display
(3) Lead state display
(4) Configuration parameters
(5) Source code (listing) of Level I program
(6) Remarks pages of Level III program

Since items 2, 3, and 4 are always in memory, their current status can be printed out at any time.

Item 1 requires a previous Run Monitor or Run Program operation to accumulate data in the input buffer before that data can be printed out. Note that the input buffer printout duplicates the presently configured format of the input buffer display. Therefore under operator control, printout can be of RCV, SND, FDX, or HDX data and can be printed out in either hex or ASCII.

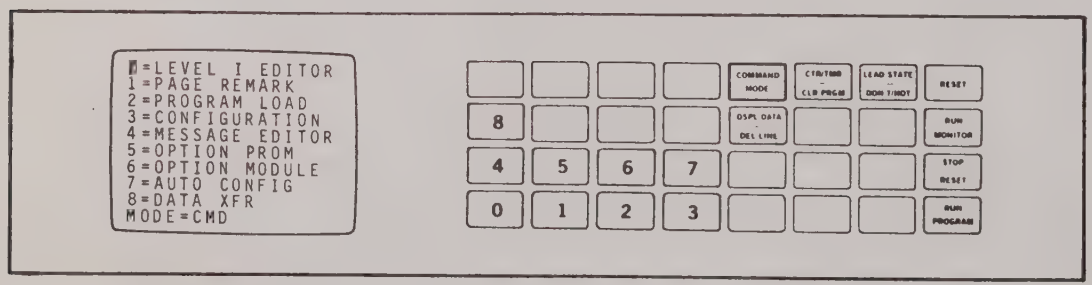
Item 5 requires a Level I program to have been previously keyed in.

Item 6 requires a Level III program (employing page remarks) to have been previously loaded and run.

The D-101 AUX port must be connected to the printer RS-232 port, and both D-101 and printer must be configured to a mutually compatible set of communication parameters (baud rate, line termination mode, form feed mode, parity mode, number of data-bits per character, and paging mode). Appendix K details these requirements.

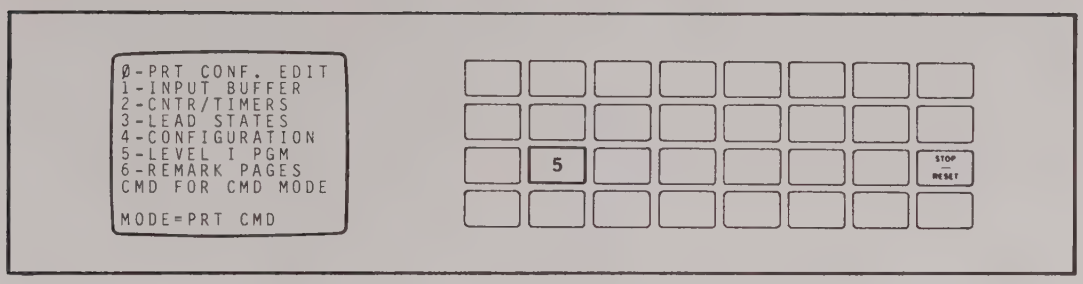
After satisfying all of the above-stated conditions, proceed as follows:

1 On the D-101 establish operation in the Command mode, with menu display, as illustrated below.

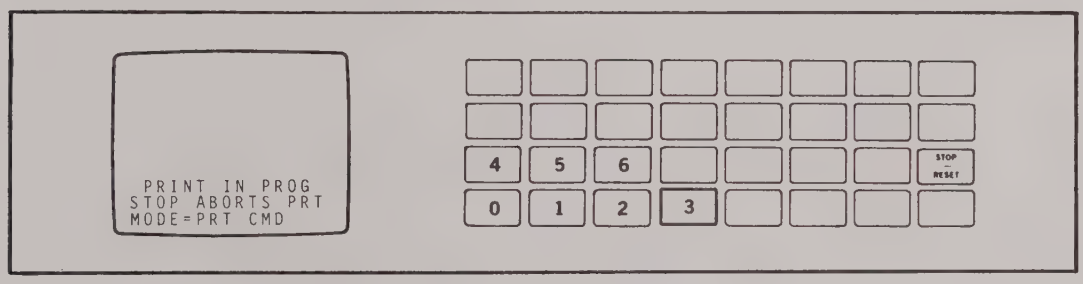


2 Install the PRINT option PROM in the ROM socket and close the drawer.

3 Press the 5 key to enable the load-from-option-PROM process, and observe the PRT CMD (print command) display.



4 With the printer on line and at top-of-form, refer to the CRT display (shown in step 3) and press the D-101 key corresponding to the desired printout. (The example shows 3 selected.) Printout begins immediately, and the CRT reports "PRINT IN PROGRESS" as illustrated below. Note that a printout in progress can be aborted by pressing the STOP key, and that unsuccessful D-101/printer communication will cause the D-101, after a few seconds, to revert to the PRT CMD menu display and report "OUTPUT TIMEOUT". (If "OUTPUT TIMEOUT" occurs, verify that the connection and configuration requirements [preceeding step 1 of this procedure] are satisfied, then repeat step 4.)



5 When the desired printout is completed, either: (1) press another key (selected from the PRT CMD menu display) for another printout, or (2) press the COMMAND MODE key to return to the Command mode in preparation for the next operation.

6. BIT ERROR RATE TEST

Both the D-101A and D-101X are equipped to perform bit-error-rate testing. This facility takes the form of an application program embodied in a PROM. This PROM (type D-101BERTO.00.00) is supplied as original equipment with all D-101A and D-101X models equipped with Rev 2 software.

In the functional area of bit-error-rate testing, the D-101A and D-101X operate in exactly the same manner. Consequently when a term such as D-101, BERT, or D-101 BERT is employed in this section, it should be understood as meaning that it applies to both D-101A and D-101X.

BERT is a versatile program that allows you to address a broad range of standard and nonstandard applications. Regardless of how it is used (for standard applications) it operates essentially as follows. BERT repeatedly outputs a known pseudo-random bit pattern (called a block) to the send-data circuit of the data channel under test. BERT concurrently monitors the receive-data circuit of that data channel, expecting to receive the same pseudo-random bit pattern. Any difference between the output and the expected input is registered by a CRT display in terms of total bit errors detected (ERR DET) and total number of blocks that contain bit error(s) (BAD BLKS). The bit errors and block errors registered by the test are then compared with locally established standards in order to evaluate the quality of data transfer via that data channel.

A. GETTING FAMILIAR WITH BERT

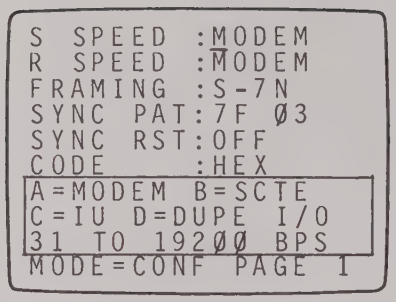
WHAT YOU SHOULD KNOW ABOUT HOW BERT WORKS

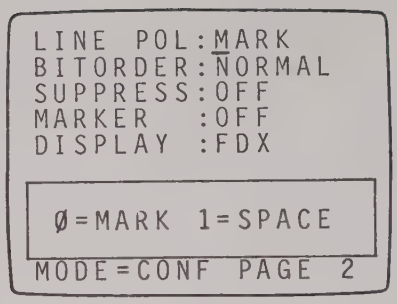
When you load the BERT program (from PROM to D-101 RAM) the BIT ERROR RATE TEST screen appears on the CRT and the following events take place:

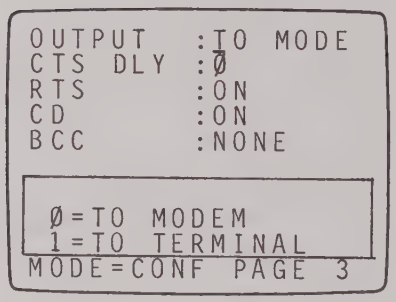
(1) BERT transfers from PROM to RAM, and D-101 control is automatically passed to the BERT program.

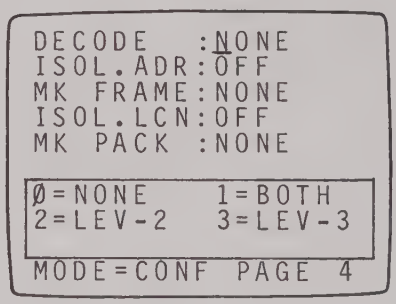
(2) BERT saves the existing set of interface-configuration parameters. These parameters are automatically restored when the BERT program is exited.

(3) BERT rewrites the configuration table with "default" values. These values (illustrated below) are suitable for all BERT operations in which modem supplies clock and the D-101 emulates DTE. The default values constitute the only set of configuration parameters that qualify as the BERT "standard" configuration. On the BIT ERROR RATE TEST screen you will have to select 1 TO ENTER NON-STD CONFIG if your application requires any change of the default values.









If modem does not supply clock, it is only necessary to set S SPEED and R SPEED to the same value as the baud rate of the data channel being tested. The resulting configuration is suitable for all BERT operations in which the D-101 supplies clock and emulates DTE.

Note: BERT is designed to run on lines operating in the synchronous data transmission mode. Even if your lines normally operate in the asynchronous transmission mode, this procedure still applies. However, in this event you will probably require the D-101(s) to supply clock.

Note: Although the configuration editor of the D-101A has three pages and that of the D-101X has four, BERT program operation is identical for both DATASCOPE models.

Numerous other valid configuration alternatives are possible for use with BERT. For example, the D-101 can emulate DCE. However, this procedure does not address applications other than:

(1) Modem supplies clock and D-101 emulates DTE

(2) D-101 supplies clock and D-101 emulates DTE

You must call upon your own resources if your application falls outside of those mentioned above.

As an added convenience for those using unusual interface configuration parameters, BERT automatically validates configuration table changes when you exit from the configuration editor. If you set up a configuration that violates the rules listed below, BERT automatically rewrites the configuration table with the default values (illustrated above) and prompts "INVALID CONFIGURATION ENTRY - DEFAULT CONFIG SET". The rules are:

(1) FRAMING must be either SYNC or ASYNC with 7 data bits. (Choice of PARITY and STOP BITS is at your discretion.)

(2) BCC must be set to NONE

(3) DECODE must be set to NONE

BERT can perform three types of tests. They are:

(1) Loopback (intended for use on an FDX channel)

(2) End-to-end (intended for use on an FDX channel)

(3) End-to-end (intended for use on an HDX channel)

For loopback operation, one D-101 is required. Assuming that the D-101 is normally configured to emulate DTE, its operation is characterized by the following:

(1) The D-101 is plugged into a modem digital interface, and the FDX channel is configured for loopback operation.

(2) A user-chosen pseudo-random bit pattern is output as send data.

(3) The data follows a path through the loopback point back to the D-101 as receive data.

(4) The D-101 tests the accuracy of the returning data.

(5) The CRT reports discrepancies in terms of total number of bit errors (ERR DET) and total number of blocks that contain (one or more) error(s) (BAD BLKS).

(6) The test runs for a user-specified number of blocks or minutes, or until manually terminated.

For end-to-end (FDX) operation, two D-101s are required. Assuming that the D-101 is normally configured to emulate DTE, its operation is characterized by the following:

(1) Each D-101 is plugged into a modem digital interface at its end of the data line.

(2) Data line configuration is not altered (from its normal setup).

(3) Both D-101s are set up to perform the same test.

(4) Assuming that both D-101s were appropriately set up (as detailed in B. OPERATING PROCEDURES FOR BERT) the interaction of the D-101s is started at one (either) end of the line (by pressing key B); the second D-101 starts when it recognizes the data pattern it is expecting.

(5) Each D-101 outputs the (same) user-chosen pseudo-random bit pattern in the form of send data.

(6) Each D-101 evaluates the accuracy of its receive data (which was output as send data by the other D-101).

(7) Each CRT reports discrepancies in terms of total number of bit errors (ERR DET) and total number of blocks with error(s) (BAD BLKS).

(8) Transmission occurs concurrently in both directions (FDX).

(9) The test runs for a user-specified number of blocks or minutes, or until manually terminated. Note that premature termination of a test at end A of the channel will cause a continuous stream of errors at end B of the channel (or vice versa). This is because the unterminated end is still expecting data.

For end-to-end (HDX) operation, two D-101s are required. The operation is the same as for end-to-end FDX operation except that transmission does not occur concurrently in both directions. Instead, one block is transmitted by the end that starts the test sequence, and the line is then automatically "turned around" to accommodate transmission of one block from the other end. The process repeats until the entire test sequence is complete.

In summary, if you account for the fact that end-to-end tests require two D-101s and loopback tests require only one, the steps of operation are the same regardless of which type of test you employ. The only essential differences are that:

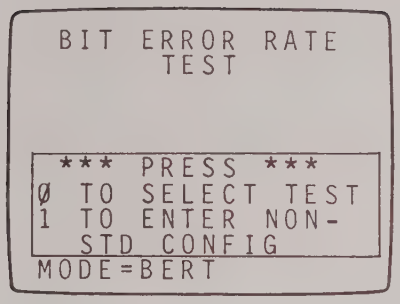
(1) End-to-end tests require the same operating steps to be performed at both ends of the line (apart from the initiating step, which is performed at one end only).

(2) Loopback test steps are all performed at the single D-101.

WHAT YOU SHOULD KNOW ABOUT BERT'S CRT SCREENS

The BERT program provides a series of CRT screens to guide you through set up and operation. Once you are familiar with BERT, the screens will provide all of the guidance you need. To help in the familiarization process, the screens are illustrated below along with appropriate comments.

The BIT ERROR RATE TEST screen (illustrated below) is the sign-on message of the BERT program. Choice 1 enables you to access the BERT configuration editor (which is not necesary if modem supplies clock and the D-101 emulates DTE). Choice 0 enables you to bypass the BERT configuration editor.



The SELECT BERT BIT PATTERN screen (illustrated below) allows you to select the bit pattern, test type, and test protocol to match the application at hand. Choice 1 applies to an end-to-end test of an HDX data channel. All other choices apply to both loopback test and end-to-end test of a FDX data channel.

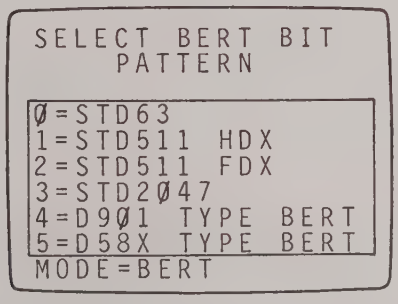
Choice Ø yields a 63-bit pattern developed by the polynomical X^6+X^5+1.

Choices 1 and 2 yield a 511-bit pattern developed by the polynomical X^9+X^5+1. This is the pattern specified by CCITT Recommendation V.52.

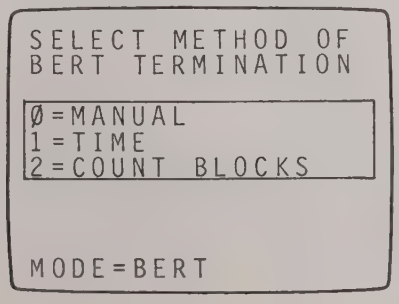
Choice 3 yields a 2407-bit pattern developed by the polynomical $X^{11}+X^9+1$.

Choice 4 yields a bit pattern and protocol compatible with the BERT function of DATASCOPE Model D-901.

Choice 5 yields a bit pattern and protocol compatible with the BERT function of DATASCOPE Models D-582, D-584, and D-586.



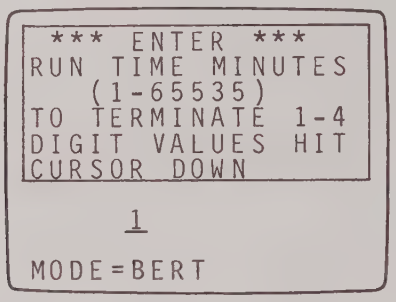
The SELECT METHOD OF BERT TERMINATION screen (illustrated below) allows you to specify the method by which a test is terminated.

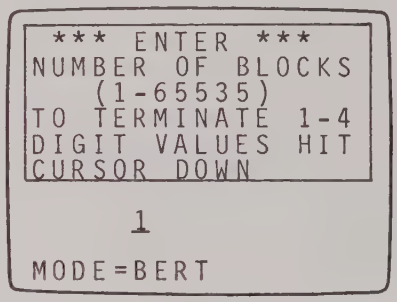


Choice 0 causes the test to run until manually terminated (by pressing STOP key).

Choice 1 calls up a screen (illustrated below) that allows you to specify the number of minutes a test will run (until the test is automatically terminated by the BERT program).

Choice 2 calls up a screen (illustrated below) that allows you to specify the number of blocks a test will run (until the test is automatically terminated by the BERT program).



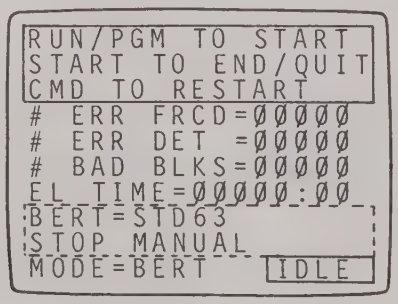


The MODE=BERT IDLE screen (illustrated below) allows you to verify the BERT bit pattern and method of BERT termination currently in effect. (These parameters are shown on display lines 8 and 9.) This screen also notifies you of three presently available command choices.

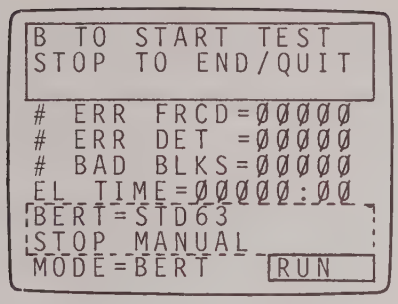
Choice of CMD (press COMMAND MODE key) enables you to go back to the start of the setup sequence and reconfigure the BERT parameters.

Choice of STOP (press STOP key) aborts the BERT program and restores the set of interface configuration parameters that existed at the time BERT was loaded from PROM to RAM.

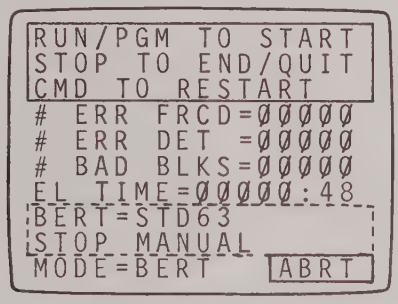
Choice of RUN/PROG (press RUN PROGRAM key) causes the BERT program to enter its RUN mode (which is described in the next screen).



The MODE=BERT RUN screen (illustrated below) indicates that BERT can be started running by detecting the currently configured BERT bit pattern on the receive data circuit. This mode provides for the inter-unit synchronization required by end-to-end tests. The screen also notifies you of two presently available command choices.



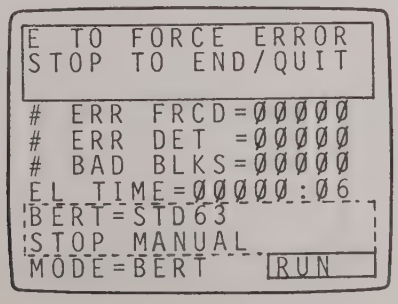
Choice of STOP (press STOP key) calls up the MODE=BERT ABRT screen (illustrated below). This screen provides the same command choices as the MODE=BERT IDLE screen (previously described).



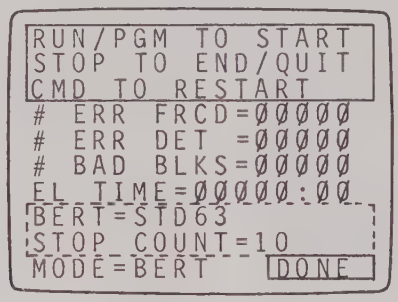
Choice of B (press B key) initiates active testing, and calls up a second type of MODE=BERT RUN screen (illustrated below). This screen persists for the duration of the test. During this time the information fields (ERR FRCD, ERR DET, BAD BLKS, and EL TIME) show current test status, and prompt fields (E TO FORCE ERRORS and STOP to END/QUIT) notify you of two presently available command choices.

Choice of E (press E key) allows you force one error each time the key is pressed.

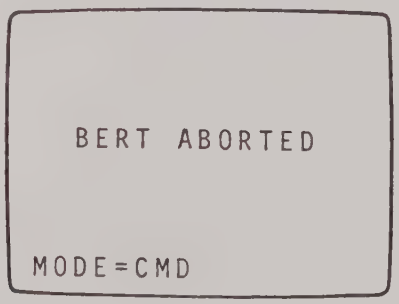
Choice of STOP (press STOP key) allows you to terminate TIME or COUNT BLOCK test prematurely and also to terminate MANUAL tests naturally. In either case the MODE=BERT ABRT screen (previously described) will appear upon test termination.



The MODE=BERT DONE screen (illustrated below) indicates that a TIME or COUNT BLOCKS test has run to its natural conclusion. The information fields (ERR FRCD, ERR DET, BAD BLKS, and EL TIME) show the final results for the test, and the prompt fields (RUN/PGM to START, STOP TO END/QUIT, and CMD to RESTART) provide you with the same command choices as the MODE=BERT IDLE screen (previously described).

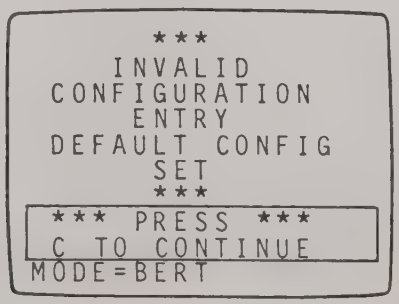


The BERT ABORTED screen (illustrated below) indicates that you have exited the BERT program, passed control to the D-101 operating system Command mode, and restored the set of D-101 interface configuration parameters that existed before BERT was loaded from PROM to RAM.



The INVALID CONFIGURATION ENTRY screen (illustrated below) indicates that you attempted to enter an invalid (for BERT) set of interface configuration parameters. Note that BERT interface configuration parameters are automatically set to the default values (previously described) when this screen appears.

Choice of C (press C key) is the only command option open to you. When you press C, you can continue with BERT operation from the SELECT BERT BIT PATTERN screen (previously described).



B. OPERATING PROCEDURES FOR BERT

The following test procedures address three types of tests:

(1) Loopback (intended for use on FDX data channel)

(2) End-to-end (intended for use on FDX channel)

(3) End-to-end (intended for use on HDX channel)

They are valid for two sets of conditions:

(1) Modem supplies clock and D-101 emulates DTE

(2) D-101 supplies clock and D-101 emulates DTE

These procedures employ synchronous data; however, the procedures work equally well (and without alteration) on asynchronous data channels.

The BERT program permits you to use all D-101 facilities that are not in direct conflict with BERT requirements. For example, the D-101 can emulate DCE and/or employ asynchronous data.

Numerous other special applications can be addressed and alternative (interface) configuration parameters can be used; however, for these and other unusual applications you must call upon your own resources. If at all practicable, use the test methods provided here.

LOOPBACK TEST PROCEDURE FOR FDX DATA CHANNEL

This procedure is designed to address the following set of conditions:

(1) You are testing a full-duplex data channel.

(2) The data channel is configured for loopback.

(3) You are connecting the D-101 to a digital modem interface. (The D-101 is configured as DTE.)

(4) The modem may or may not supply clock. (Both conditions are addressed by the procedure, and in either case the BERT is performed using synchronous data.)

Each time the test is run to its conclusion, this procedure will permit you to determine the following information about data transfer via the loop:

(1) Total number of bit errors detected.

(2) Total number of blocks in which one or more errors were detected.

(3) Total time test ran.

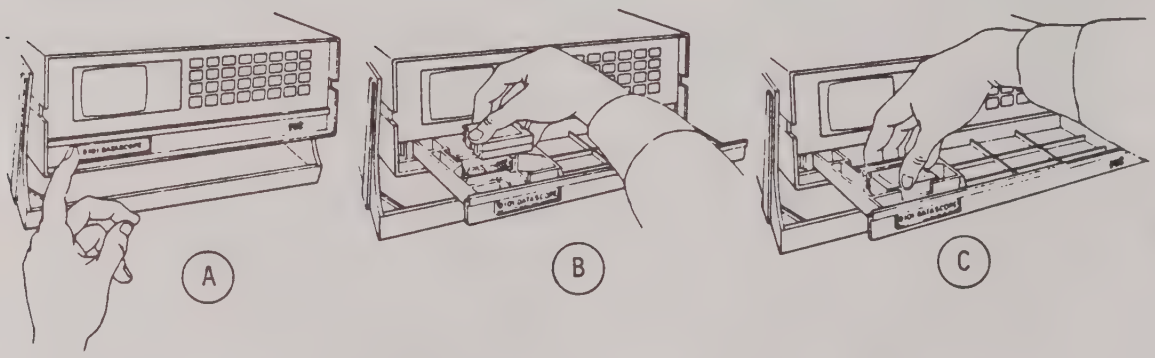
When the above conditions are met, proceed as follows:

1 Using a standard data cable, connect the MODEM connector of the D-101 to the RS-232 port of the modem.

2 On the D-101, establish command mode, with the menu display as shown below.

```
Ø=LEVEL I EDITOR
1=PAGE REMARK
2=PROGRAM LOAD
3=CONFIGURATION
4=MESSAGE EDITOR
5=OPTION PROM
6=OPTION MODULE
7=AUTO CONFIG
8=DATA XFR
MODE=CMD
```

3 Install PROM type "D101BRTO.00.00" in the socket of the D-101 front panel drawer.



4 Press key 5; verify that the display shown below appears on the CRT.

```
BIT ERROR RATE
     TEST

  *** PRESS ***
Ø TO SELECT TEST
1 TO ENTER NON-
  STD CONFIG
MODE=BERT
```

5 If the modem supplies clock, press key Ø and go to step 6. If the modem does not supply clock, proceed as follows:

a. Press key 1; the configuration editor page 1 display appears on the CRT.
b. Set S SPEED and R SPEED to the baud rate of the channel being tested.
c. Press the COMMAND MODE key.
d. Go to step 6.

```
S SPEED :MODEM
R SPEED :MODEM
FRAMING :S-7N
SYNC PAT:7F Ø3
SYNC RST:OFF
CODE    :HEX
A=MODEM B=SCTE
C=IU D=DUPE I/O
31 TO 19200 BPS
MODE=CONF PAGE 1
```

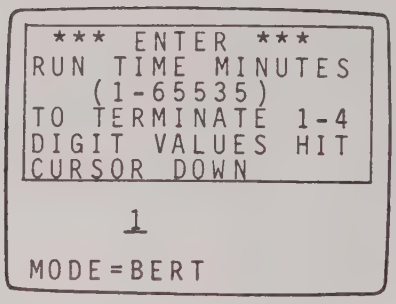
6 Verify that the display shown below appears on the CRT.

```
SELECT BERT BIT
    PATTERN

Ø=STD63
1=STD511 HDX
2=STD511 FDX
3=STD2047
4=D901 TYPE BERT
5=D58X TYPE BERT
MODE=BERT
```

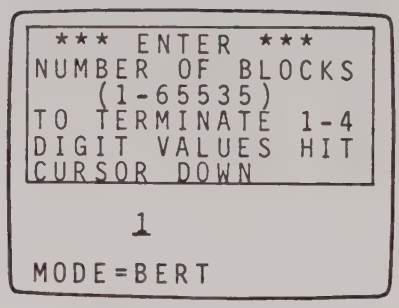
7 You may select any BERT BIT PATTERN you wish to except type 1 (STD511 HDX). The best choice for your application is probably Ø, 2, or 3, whichever uses a block length similar to that employed on the data line being tested. Press the key corresponding to your choice and verify that the display shown below appears on the CRT.

```
SELECT METHOD OF
BERT TERMINATION

Ø=MANUAL
1=TIME
2=COUNT BLOCKS


MODE=BERT
```

8 You may select any METHOD OF BERT TERMINATION you wish. MANUAL runs until manually terminated, TIME runs for the number of minutes you specify (in the next step), and COUNT BLOCKS runs until it completes testing the number of blocks you specify (in the next step). (TIME and COUNT can be manually terminated while the test is in progress.) Press the key corresponding to your choice. If your choice is Ø, go to step 10; otherwise, continue with step 9. If you chose 1, verify that Display 1 (below) appears on the CRT. If you chose 2, verify that Display 2 (below) appears on the CRT.



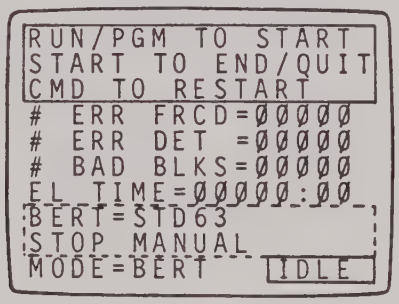
Display 1



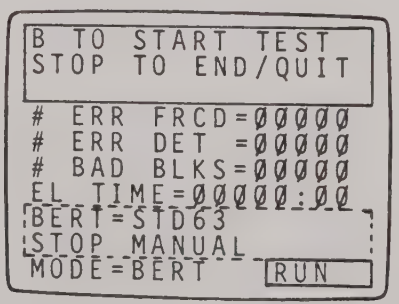
Display 2

9 Key in the number of run-time minutes or blocks, whichever applies. Terminate 1-4 digit values with the cursor down (▼) key. When the count or time value is completely entered, verify that a version of the display shown in step 9 appears on the CRT. COUNT or TIME (followed by the value you selected) will appear on the CRT instead of MANUAL (as illustrated in step 10).

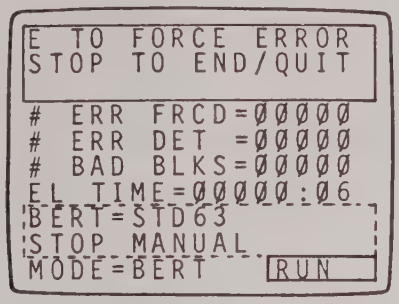
10 Verify that the display shown below appears on the CRT, then press the RUN/PROGRAM key.



11 Verify that the display shown below appears on the CRT. The test is fully set up and will actually begin when you perform step 12.

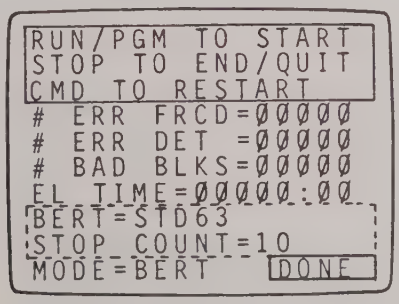


12 Press key B, verify that the display shown below appears on the CRT and that the EL TIME display field is registering time elapsed (since the test was started by pressing key B). If you would like to verify that the test is running, you can access the lead states display and observe the activity displayed. (LEAD STATE key invokes/revokes lead state display.)



Note that the BERT display is automatically updated as the test progresses. ERR DET registers the total number of errors detected. BAD BLKS registers the total number of blocks with error(s). (Example: three errors in one block will advance ERR DET by three, and BAD BLKS by one.) Also note that you can intentionally force error(s) by pressing key E as the test runs, and that you can manually terminate a timed or block-counted test by pressing the STOP key.

13 When the test is terminated (time expires, block count is reached, or STOP key is pressed), verify that a variation of the display shown below appears on the CRT. You can evaluate the test results and then: (1) press the RUN/PROGRAM key and repeat the same test (go back to step 11), (2) press the COMMAND MODE key to run a different test (go back to step 4), or (3) press the STOP key to exit the BERT program and return to the command mode.



END-TO-END TEST FOR FDX OR HDX DATA CHANNEL

This procedure is designed to address the following set of conditions:

(1) You are end-to-end testing a full-duplex or half-duplex (switched carrier) data channel.

(2) A BERT device and operator are available at both ends of the data communication channel. (If you are not using two D-101s, you will have to adapt the steps of the procedure below to suit the requirements of the BERT device you are using.)

(3) Provision has been made for verbal communication between the operators.

Each time the test is run to its conclusion, this procedure will permit you to determine the following information about data transfer via one data circuit of the line:

(1) Total number of bit errors detected.

(2) Total number of blocks in which one or more errors were detected.

(3) Total time test ran.

When the above conditions are met, proceed as follows:

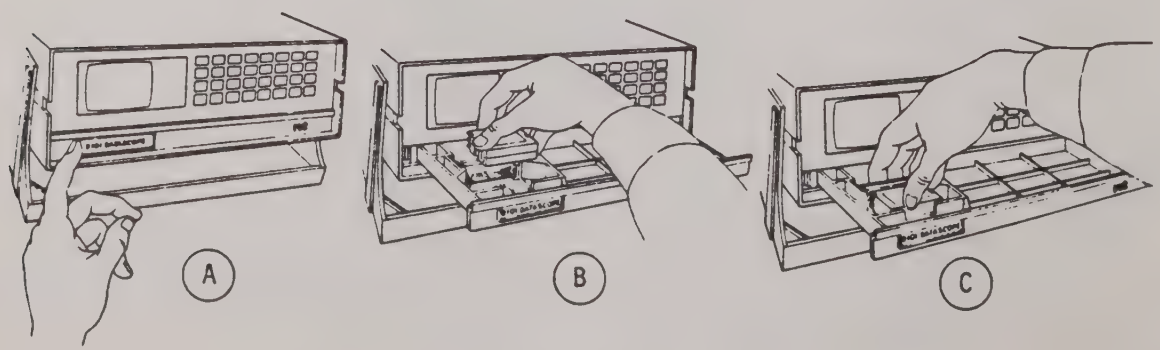
At both ends of the data channel --

1 Using a standard data cable, connect the MODEM connector of the D-101 to the RS-232 port of the modem.

2 Establish command mode, on the D-101, with the menu display as shown below.

```
Ø=LEVEL I EDITOR
1=PAGE REMARK
2=PROGRAM LOAD
3=CONFIGURATION
4=MESSAGE EDITOR
5=OPTION PROM
6=OPTION MODULE
7=AUTO CONFIG
8=DATA XFR
MODE=CMD
```

3 Install PROM type "D101BRTO.00.00" in the socket of the D-101 front panel drawer.



4 Press key 5; verify that the display shown below appears on the CRT.

```
BIT ERROR RATE
     TEST

 *** PRESS ***
Ø TO SELECT TEST
1 TO ENTER NON-
  STD CONFIG
MODE=BERT
```

5 If the modem supplies clock, press key Ø and go to step 6. If the modem does not supply clock, proceed as follows:

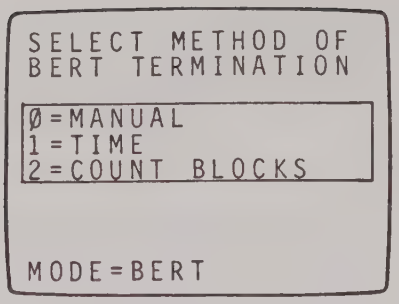
a. Press key 1; the configuration editor page 1 display appears on the CRT.
b. Set S SPEED and R SPEED to the baud rate of the channel being tested.
c. Press the COMMAND MODE key.
d. Go to step 6.

```
S SPEED :MODEM
R SPEED :MODEM
FRAMING :S-7N
SYNC PAT:7F Ø3
SYNC RST:OFF
CODE    :HEX
A=MODEM B=SCTE
C=IU D=DUPE I/O
31 TO 19200 BPS
MODE=CONF PAGE 1
```

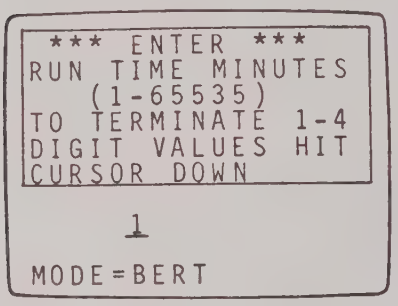
6 Verify that the display shown below appears on the CRT.

```
SELECT BERT BIT
    PATTERN

Ø=STD63
1=STD511 HDX
2=STD511 FDX
3=STD2Ø47
4=D9Ø1 TYPE BERT
5=D58X TYPE BERT
MODE=BERT
```

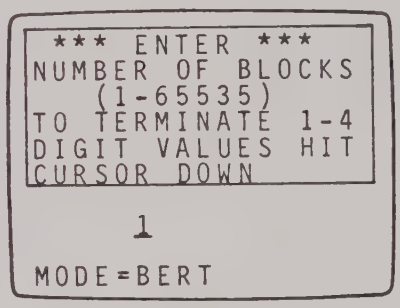
7 If you are testing a full-duplex data channel, you may select any BERT BIT PATTERN you wish except type 1 (STD511 HDX). The best choice for your application is probably Ø, 2, or 3, whichever employs a block length similar to that employed on the data line being tested. If you are testing a half-duplex (switched carrier) data channel, choose the STD511 HDX test. Press the key corresponding to your choice and verify that the display shown below appears on the CRT.



8 You may select any METHOD OF BERT TERMINATION you wish provided the same choice is made at both ends of the data channel. MANUAL runs until manually terminated, TIME runs for the number of minutes you specify (in the next step), and COUNT BLOCKS runs until it completes testing the number of blocks you specify (in the next step). (TIME and COUNT can be manually terminated while the test is in progress.) Press the key corresponding to your choice. If your choice is Ø, go to step 10. Otherwise, continue with step 9. If you chose 1, verify that Display 1 (below) appears on the CRT. If you chose 2, verify that Display 2 (below) appears on the CRT.



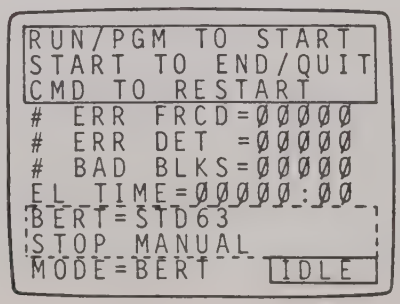
Display 1



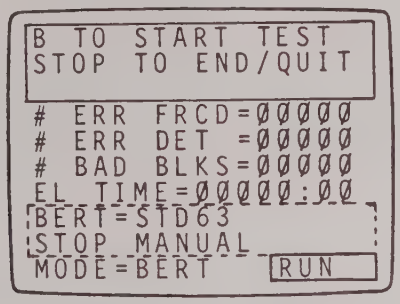
Display 2

9 Key in the same number of run-time minutes or blocks, whichever applies. Terminate 1-4 digit values with the cursor down (▼) key. When the count or time value is completely entered, verify that a version of the display shown in step 9 appears on the CRT. COUNT or TIME (followed by the value you selected) will appear on the CRT instead of MANUAL (as illustrated in step 10).

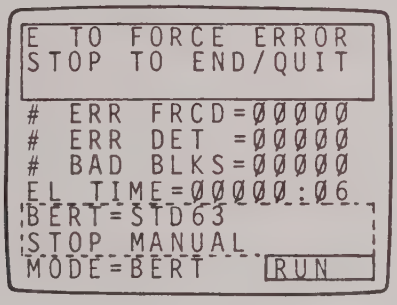
10 Verify that the display shown below appears on the CRT, then press the RUN/PROGRAM key.



11 Verify that the display shown below appears on the CRT. The test is fully set up and will actually begin when you perform step 12.

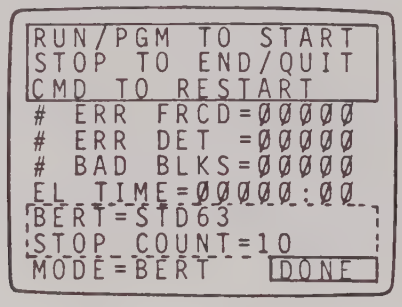


12. At either end (but only one end) of the data channel, press key B. This action starts both D-101s running. Verify that the display shown below appears on the CRT and that the EL TIME display field is registering time elapsed (since the test was started by pressing key B). If you would like to verify that the test is running, you can access the lead states display and observe the activity displayed. (LEAD STATE key invokes/revokes the lead state display.)



Note that the BERT display is automatically updated as the test progresses and that each D-101 registers errors that appear on its receive-data circuit. ERR DET registers the total number of errors detected. BAD BLKS registers the total number of blocks with error(s). (Example: three errors in one block will advance ERR DET by three, and BAD BLKS by one.) Also note that you can intentionally force error(s), by pressing key E as the test runs, and that you can manually terminate a timed or block-counted test by pressing the STOP key. Errors forced at end A register at end B, and vice versa.

13. When the test is terminated (time expires, block count is reached, or STOP key is pressed), verify that a variation of the display shown below appears on the CRT. You can evaluate the test results (on both units) and then: (1) press the RUN/PROGRAM key (on both units) and repeat the same test (go back to step 11), (2) press the COMMAND MODE key (on both units) to run a different test (go back to step 4), or (3) press the STOP key to exit the BERT program and return to the command mode. Note that premature termination of a test at end A of the channel will cause a continuous stream of errors at end B of the channel (or vice versa). This is because the unterminated end is still expecting data.



APPENDIX A

USER CONFIDENCE TEST

The D-101 power on/reset user confidence test (also referred to as "self-test") is actually a series of automatically initiated tests of ROM, RAM, video display, input buffer, and front panel keyboard. All tests are automatically implemented except for the keyboard test, which requires operator intervention (if the operator chooses to do it). The self-test is started upon depression of the D-101 rear panel POWER switch to its ON position; it may also be initiated by concurrent depression of the RESET and STOP/RESET keys. As the self test runs, assuming no errors are encountered, the confidence test will, after a few seconds, come to a display, the lower part of which reads "D101A-2 CONF TST" or "D101X-2 CONF TST". The "A-2" appended to "D101" indicates that standard rev 2 operating system software is installed in the unit and the "X-2" indicates that the bit-oriented protocol system software is installed. Note that the rev 3 operating system software invokes a display of A-3 (instead of A-2) or X-3 (instead of X-2).

The self-test consists of three separate tests which are executed in a continuous loop that is sustained until one of the following occurs:

(a) An error is detected. If this occurs, the sequence of tests is halted, and an error message is automatically displayed. The error message (see Table A-1 for detailed descriptions of error messages) identifies the failing test and gives specific information regarding the failure (e.g., memory address where failure occurred, the input test data, and the data found to be in error).

(b) The COMMAND key is depressed while test 3 is in effect (D101A-2 CONF TST, D101X-2 CONF TST, D101A-3 CONF TST, or D101X-3 CONF TST displayed on screen). This action terminates testing and invokes the D-101 Command mode; this is the normal method of exiting the self- test.

Test 1 (ROM Verify Test) computes two 16-bit checksum values for each Operating System ROM and compares the results to stored checksum values. If an error is detected, the failing ROM is identified on the CRT.

Test 2 (RAM Verify Test) executes four separate tests of the 32K dynamic RAM and the video display RAM. If an error is detected, the failing RAM test number, memory address where the error occurred, test pattern involved, and error data are identified in the error message.

Test 3 (Video Display, Input Buffer Transfer, and Keyboard Test) writes data to the input buffer, to verify proper functioning of the display memory and input buffer data transfer, and also allows for keyboard testing. (Operator intervention using the keyboard is required if keyboard testing is desired.) All character sets included in the D-101 under test are displayed sequentially in full-screen patterns. The first display page of each set contains the characters corresponding to character codes 00-7F, and the second page of each set contains the characters corresponding to 80-FF. The third and fourth pages display the same sequence, but in shifted mode. The characters are displayed in ascending order of character code on each line. The display changes to the next display page once every five seconds.

For one complete cycle of test 3, the displays sequence (in order) through the hex, user (default=EBCDIC), ASCII, and EBCDIC code sets. The characters are displayed in "normal video" (white-on-black, full intensity) only for all code types except hex, resulting in four screens of characters (2 unshifted, then 2 shifted) for each of the non-hex code sets. Additionally, for the hex code set only, attribute modes

are presented (also shifted and unshifted), and the following display sequence occurs, resulting in a total of 20 hex code displays:

(a) Normal video
(b) Negative video (screen ID=INVIMG)
(c) Underlined, in normal video (screen ID=UNDLIN)
(d) Low intensity (screen ID=LOWINT)
(e) Dummy dot, in normal intensity (screen ID=DDOT)

The identifiers: D101A-2 CONF TST, D101X-2 CONF TST, D101A-3 CONF TST, or D101X-3 CONF TST character code range (00-7F or 80-FF), code type or attribute being tested, and unshifted/shifted status (blank or SHF) are displayed in the bottom area of the screen during test 3. If the FREEZE key is depressed while in test 3, the display will be frozen until the ENTER key is depressed. Depressing any key except the COMMAND or ENTER keys while the display is frozen will cause the hex code of the depressed key (i.e., key test value) to be displayed on line 10, character position 16. This permits manual testing of each key individually (if desired) by the operator. Proper functioning of the COMMAND and ENTER keys may be verified by observing that the appropriate response occurs when the key is depressed (COMMAND key invokes Command mode and ENTER key unfreezes display). The proper key test values are presented in Table E-1.

The displays in test 3 may be "stepped through" at an accelerated rate without waiting the full five seconds for displays to change by alternately depressing the FREEZE and ENTER keys repeatedly to activate the next display in the sequence. To use this feature properly, the two keys should not be depressed simultaneously or operated at rates that are too fast to permit the display to respond.

After each block of data is written into the input buffer, the tranfer is verified by comparing the current input buffer block to the corresponding block written into the display memory. If an error is detected, the input buffer and display memory addresses and data involved in the failure are identified in the error message.

TABLE A-1. SELF-TEST ERROR MESSAGES

TEST NO.	TEST NAME	ERROR MESSAGE DESCRIPTION
1	ROM Verify	Error Message: ROM# CHECKSUM ERROR where: # = failing ROM number.
2	RAM Verify	Error Message: RAM ERROR TEST# ADDR--xxxx tp ed where: # = RAM test number that failed (1-4) xxxx = memory address where error occurred tp = test pattern ed = error data
3	Video Display, Input Buffer Transfer, and Keypad Test	Error Message: XFRERR-iiii=id vvvv=vd where: iiii = input buffer address id = input buffer data vvvv = video buffer address vd = video buffer data

APPENDIX B

AUTOCONFIGURATION REQUIREMENTS

The autoconfiguration function provides the D-101 with a limited capability for "reading" a data line and setting its own configuration parameters to accommodate the data encountered. The function is accessed by pressing the 7 key when the CRT prompts MODE=CMD while the D-101 is connected for monitoring (as shown in Section 3.1).

Table B-1 summarizes the configuration-parameter "sets" to which the D-101 equipped with Rev 2 software is able to configure automatically. Table B-2 summarizes the configuration-parameter "sets" to which the D-101 equipped with Rev 3 software is able to configure automatically. Other configuration-parameter "sets" must be entered manually as described in Appendix C.

Where the D-101 is equipped with Rev 2 software, in order for the autoconfiguration process to succeed, the following conditions must exist while autoconfiguration is in progress:

1. The data line must provide both data and idle-line conditions.

2. If the D-101 is autoconfiguring to a synchronous data line, clocks must also be present.

3. If the line protocol employs sync character(s), that sync pattern must occur at least once during each 512 characters, and the sync pattern must be immediately preceeded by at least two seconds of idle line.

4. If the line protocol does not employ sync character(s), an idle-line condition must occur for at least two seconds between each 512 characters.

5. The online baud rate must be (within approximately ±8% of) one of the following baud rates: 50, 75, 110, 134.5, 150, 300, 600, 1200, 1800, 2000, 2400, 3600, 4800, 7200, or 9600.

Note that the autoconfiguration process automatically aborts, returning control to Command mode, if the configuration cannot be determined within 60 seconds. If this occurs, an error message (described in Appendix I) will be displayed.

TABLE B-1. CONFIGURATIONS DETECTED/ESTABLISHED BY AUTOCONFIGURATION FUNCTION OF UNITS EQUIPPED WITH REV 2 SOFTWARE

CONFIGURATION ITEM	CONFIGURATION GROUP NUMBER *				
	1	2	3	4	5
S SPEED	MODEM	MODEM	MODEM	MODEM	①
R SPEED	MODEM	MODEM	MODEM	MODEM	①
FRAMING	SDLC D	SYNC 8N	SYNC 70	SYNC 7E	A 70-1 ③
SYNC PAT	7E	32 32 ②	16 16 ②	96 96 ②	NONE
SYNC RST	OFF	FF	FF	FF	OFF
CODE	ASCII	EBCDIC	ASCII	ASCII	ASCII
LINE POL	MARK or SPACE	MARK or SPACE	MARK or SPACE	MARK or SPACE	MARK or SPACE
BITORDER	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL
SUPPRESS	OFF	OFF	OFF	OFF	OFF
MARKER	OFF	OFF	OFF	OFF	OFF
DISPLAY	FDX	FDX	FDX	FDX	FDX
OUTPUT	TO MODEM	TO MODEM	TO MODEM	TO MODEM	TO MODEM
CTS DLY	Ø	Ø	Ø	Ø	Ø
RTS	ON	ON	ON	ON	ON
CD	ON	ON	ON	ON	ON
BCC	CRC-CCITT	CRC-16	LRC-8	LRC-8	LRC-8

*Configuration group numbers are arbitrarily assigned. They are for convenience of reference only.

① One of the following speeds: 50, 75, 110, 135, 150, 300, 600, 1200, 1800, 2400, 3600, 4800, 7200, 9600.

② Sy Sy (hex-pair characters 16 16, 32 32, or 96 96) must occur at least once within 512 on-line characters to autoconfigure to a synchronous data-line.

③ Autoconfiguration recognizes only Async ASCII. Asynchronous transmission of an 8-bit code, such as EBCDIC, will be interpreted as Async ASCII; 7-bits with many parity errors. Manually reset FRAMING to A-8N.

In order for the autoconfiguration process to succeed where the D-101 is equipped with Rev 3 software, editor compiler PROM type D101ECP.03.00 must be installed in the PROM socket of the front-panel drawer, and the following conditions must exist while autoconfiguration is in progress.

With synchronous lines:

1. The data line must provide both data and idle line conditions.

2. The idle line condition must be at least 24 bit times.

3. Both send and receive clocks must be present.

4. Sync characters must occur at least once every 512 characters and they must be preceded by at least 24 bit times of idle line.

5. The data line must contain only one sync pattern -- 3232, 1616, or 9696.

With asynchronous lines:

1. The data line must provide both data and idle line conditions.

2. The idle line condition must be at least 24 bit times.

3. No clocks should be present.

4. Idle line condition must occur once every 512 characters.

With SDLC lines:

1. The data line must provide both data and idle line conditions.

2. The idle line condition must be at least 24 bit times for lines that idle FFs or at least 6 bit times for lines that idle 7Es. For lines that idle 7Es, however, the time required to autoconfigure is significantly longer than for those lines that idle FFs. For this reason, the ability to autoconfigure will be greatly reduced at speeds below 1200 bps (on lines that idle 7Es) -- if autoconfiguration takes place at all.

3. Both send and receive clocks must be present.

4. Sync characters (7E) must occur at least once every 512 characters, and they must be preceded by an idle line state.

5. All messages must contain BCC results.

Note that if messages are used with blocks of data containing 512 characters, the probability of reliable configuration to the line will be less than 100 percent. At speeds that require more than one minute to pass 512 characters, autoconfiguration probably will not take place.

TABLE B-2. CONFIGURATIONS DETECTED/ESTABLISHED BY AUTOCONFIGURATION FUNCTION OF UNITS EQUIPPED WITH REV 3 SOFTWARE

CONFIG-URATION ITEM	CONFIGURATION TYPE						
	SDLC D	SDLC N	SYNC 8N	SYNC 7O	SYNC 7E	ASYNC 7O	ASYNC 7E
	CONFIGURATION PARAMETERS DECTECTED/ESTABLISHED						
S SPEED	MODEM	MODEM	MODEM	MODEM	MODEM	speed①	speed①
R SPEED	MODEM	MODEM	MODEM	MODEM	MODEM	speed①	speed①
FRAMING	SDLC D	SDLC N	S-8N	S-7O	S-7E	A-7O②	A-7E 1②
SYNC PAT	7E	7E	32 32	16 16	96 96	NONE	NONE
SYNC RES	OFF	OFF	FF①	FF①	FF①	OFF	OFF
CODE	ASCII	EBCDIC	EBCDIC	ASCII	ASCII	ASCII	ASCII
LINE POL	MARK/ SPACE③	MARK	MARK/ SPACE③	MARK/ SPACE③	MARK/ SPACE③	MARK/ SPACE③	MARK/ SPACE③
BITORDER	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL
SUPPRESS	OFF	OFF	OFF	OFF	OFF	OFF	OFF
MARKER	OFF	OFF	OFF	OFF	OFF	OFF	OFF
DISPLAY	FDX	FDX	FDX	FDX	FDX	FDX	FDX
OUTPUT	TO MODEM	TO MODEM	TO MODEM	TO MODEM	TO MODEM	TO MODEM	TO MODEM
CTS DLY	Ø	Ø	Ø	Ø	Ø	Ø	Ø
RTS	ON	ON	ON	ON	ON	ON	ON
CD	ON	ON	ON	ON	ON	ON	ON
BCC	CCITT	CCITT	CRC-16	LRC-8	LRC-8	LRC-8	LRC-8

Speeds supported - 50, 75, 110, 135, 150, 300, 600, 1200, 1800, 2400, 3600, 4800, 7200, and 9600.

KEY TO ENCIRCLED NUMBERS IN TABLE B-2

① For async line protocols, the speed of the line will be entered here.

② 1 Stop Bit for speeds 300 and above, 2 Stop Bits for speeds below 300.

③ This entry is determined by the line polarity of the tested line.

APPENDIX C

CONFIGURATION TABLE FIELDS

Table C-1 is a summary of the information required to intelligently select and key-in appropriate configuration parameters for any application the D-101 is designed to address. This table is divided into three pages corresponding to the first three pages of the CRT configuration table display. (Note that page 4 of the D101X-2 display presents the configuration parameters for the decode/display facility covered in the supplement to this book entitled "Decode/Display Facility for Bit-Oriented Protocols". The significance of the Table C-1 column headings is as follows:

ITEM
: Keys appropriate section of Table C-1 to same-named item of D-101 configuration table display.

APPLICABILITY
: Describes what D-101 functions and/or facilities are affected.

PURPOSE
: Describes the purpose for which the configuration-table item is provided.

DESIRED PARAMETER
: Lists the selection of parameters available for the configuration-table item.

REQUIRED KEYSTROKES
: Presents the keystroke or sequence of keystrokes required to enter the desired parameter(s).

REMARKS
: Provides background information useful in selecting appropriate parameters for each configuration-table item.

ITEM	APPLICABILITY	PURPOSE	DESIRED PARAMETER	REQ KEY
S SPEED	All D-101-to-data-line transactions involving send data	Match data-clock speed of D-101 to data-clock speed employed by data source of interest	MODEM	A
			SCTE	B
			IU	C
			DUPE I/O	D
			31-19200 (BPS)	De de va
R SPEED	All D-101-to-data-line transactions involving receive data	Match data-clock speed of D-101 to data-clock speed employed by data source of interest	MODEM	A
			SCTE	B
			IU	C
			DUPE RCV	D
			31-19200 (BPS)	De de va
FRAMING	All D-101-to-data-line transactions involving send data and/or receive data	Match the character-framing mode of D-101 to the character-framing type employed by data source of interest	Async, 8 bits (N, O, E), 2 stop bits	Ø8
			Async, 7 bits (N, O, E), 2 stop bits	Ø7
			Async, 6 bits (N, O, E), 2 stop bits	Ø6
			Async, 5 bits (N, O, E), 2 stop bits	Ø5
			Async, 8 bits (N, O, E), 1 stop bit	Ø8
			Async, 7 bits (N, O, E), 1 stop bit	Ø7
			Async, 6 bits (N, O, E), 1 stop bit	Ø6
			Async, 5 bits (N, O, E), 1 stop bit	Ø5
			Sync, 8 bits (N, O, E)	18
			Sync, 7 bits (N, O, E)	17
			Sync, 6 bits (N, O, E)	16
			Sync, 5 bits (N, O, E)	15
			SDLC DIR	2
			SDLC NRZI	3
SYNC PAT	All D-101-to-data-line transactions involving send data and/or receive data if FRAMing type "Sync" or "SDLC" is in effect	Match the sync pattern that the D-101 will recognize (to establish character framing) to the sync pattern employed by the data source of interest	One hex pair (00-FF)	1 he
			Two hex pairs (00-FF and 00-FF)	2 he
SYNC RST	All D-101-to-data-line transactions involving send data (SD) and/or receive data if FRAMING type "Sync" or "SDLC" is in effect.	Select either function OFF or a SYNC RST character in the form of a hex pair	OFF	0
			One hex pair (00-FF)	1 he
CODE	All CRT display of send data and/or receive data	Select "character set" that the CRT will employ to display the equivalent character for a given digital pattern	HEX	Ø
			ASCII	1
			EBCDIC	2
			USER	3

Footnote:

(1) The D-101 SYNC and SDLC framing processes cause input buffer storage of online data to begin with the first c SYNC PAT character(s). Consequently, user programs can not detect the SYNC PAT character(s) that actually c attain sync. However, user programs can detect online SYNC PAT character(s) that occur while the D-101 is "in

If four consecutive idle characters appear online while the D-101 is "in sync" the D-101 reverts to a searchi and online characters are not stored in the input buffer until the conditions mentioned in the previous para (Idle characters are defined as follows: FF for 8-bit framing, 7F for 7, 3F for 6, and 1F for 5.)

EQUIRED EYSTROKE(S)	REMARKS
	Selects "modem" clock: SCT (for send data) from interface pin 15. Invokes MODEM as R SPEED parameter.
	Selects "SCTE" clock (for send data and receive data) from interface pin 24. Invokes SCTE as R SPEED parameter.
	Selects "IU" clock (for send data and receive data) from interface pin 25. Invokes IU as R SPEED parameter.
	Sets the I/O configuration S SPEED and R SPEED parameters to the displayed value of S SPEED. Note that if MODEM is selected as the S SPEED value, the I/O configuration SPEED parameters will both default to 1200 bps.
cimal digits of sired "speed" lue	Selects "D-101 internal clock" (for send data). Number entered sets bits-per-second rate of clock.
	Selects "modem" clock: SCR (for receive data) from interface pin 17. Invokes MODEM as R SPEED parameter.
	Selects "SCTE" clock (for send and and receive data) from interface pin 24. Invokes SCTE as R SPEED parameter.
	Selects "IU" clock (for send data and receive data) from interface pin 25. Invokes IU as R SPEED parameter.
	Sets R SPEED to the same value as S SPEED
cimal digits of sired "speed" lue	Selects "D-101 internal clock" (for receive data). Number entered sets bits-per-second rate of clock.
(Ø,1,2)2 (Ø,1,2)2 (Ø,1,2)2 (Ø,1,2)2 (Ø,1,2)1 (Ø,1,2)1 (Ø,1,2)1 (Ø,1,2)1 (Ø,1,2) (Ø,1,2) (Ø,1,2) (Ø,1,2)	Selection of "Async" FRAMING automatically sets SYNC PAT to NONE and SYNC RST to OFF It also strips incoming data of start and stop bits before the data is processed by the D-101 and appends appropriate start and stop bits to data output by the D-101. Parity can be set to one of three states: None, Odd, or Even.
	In most protocols a selection of SDLC DIR generally requires an LINE POL (selection) of MARK
	In most protocols a selection of SDLC (NRZI) generally requires an LINE POL (selection) of SPACE
followed by two x digits followed by four x digits	"Character sync" for send data and receive data are completely independent of each other. However, SYNC PAT applies to both. When the D-101 detects the digital pattern specifed by SYNC PAT, character framing is established on the affected side of the line (SD and/or RD). Thereafter character framing is maintained by counting (5, 6, 7, or 8) clock pulses as specified by FRAMING. The character framing remains in effect until: (1) a SYNC RST character is detected (see SYNC RST, Remarks column), (2) the SYN RESET key is pressed (affects both SD and RD), or (3) the D-101 enters the Stop mode (automatically under control of a user program or manually by pressing the STOP key). See footnote.
	During "in sync" operation (see SYNC PAT, REMARKS) detection of the specified SYNC RST character forces the affected side of the line (SD and/or RD) to lose sync and begin an immediate search for "new sync" (as specified by SYNC PAT).
followed by two x digits	

haracter after the
used the D-101 to
sync".

ng-for-sync state,
graph occur again.

ITEM	APPLICABILITY	PURPOSE	DESIRED PARAMETER
LINE POL	All D-101-to-data-line transactions involving send data and/or receive data	Select the "polarity interpretation" the D-101 applies to all on-line data	MARK SPACE
BITORDER	All D-101-to-date-line transactions involving send data and/or receive data	Select the "bit-order interpretation" the D-101 applies to all on-line data (including D-101 output)	NORMAL REVERSE
SUPPRESS	All send data and/or receive data displayed on the CRT and captured in the input buffer	Select either function OFF or a SUPPRESS character in the form of a hex pair	OFF One hex pair (00-FF)
MARKER	All send data and/or receive data displayed on the CRT and captured in the input buffer	Select function OFF or select from ODD (parity), EVEN (parity) SQ (at EIA high), CD (at EIA high) RTS (at EIA high), CTS (at EIA high) or TP (at EIA high) to "mark" the CRT display via negative-video characters to indicate the selected condition	OFF ODD EVEN SQ CD RTS CTS TP
DISPLAY	All CRT display of D-101-to-data-line transactions involving send data and/or receive data	Select on-line display mode of CRT to display send data only, receive data only, or send data and receive data simultaneously	SND RCV FDX HDX

QUIRED YSTROKE(S)	REMARKS
	Normally, the proper selection of LINE POL (Mark or SPACE) also selects the proper data polarity. In those very rare instances where the relationship between line polarity and data polarity is reversed from "normal", select the proper parameter for the line polarity and invert the logical definition of all configuration and user-program parameters that specify data fields. e.g., 01011011 (5B hex becomes 10100100 (A4 hex).
	NORMAL bit order (also referred to as i-1 bit order) causes the D-101 to operate correctly when the most-significant bit (of each online character) appears online first. REVERSE bit order (also referred to as 1-8 bit order) causes the D-101 to operate correctly when the least-significant bit (of each online character) appears online first.
followed by two x digits	A number of consecutive occurrences of the same character is called a "block". On-line data may contain undesirably long blocks of a character (e.g., the idle character) that is irrelevant to the D-101 function in process. The SUPPRESS function causes the D-101 to display, and to capture in the input buffer, only the first eight characters of longer-than-eight-character blocks of the suppress-specified character.
	The marker function affects only the CRT display of data; it has no effect on data output by the D-101 even though the CRT display of that data is appropriately marked.
	The CRT employs eight lines of sixteen characters per line for display of on-line data. All eight lines are used to display send data when display type SND is in effect. Similarly, display type RCV presents eight lines of received data. Receive data, however, is always underlined for identification purposes. Display type FDX (full duplex) presents alternate lines of send data and (underlined) receive data. During FDX display the time correlation between send and receive data is always maintained; chracters in the same time slot are vertically aligned. Data activity on a given side of the line (SD or RD) is in no way influenced by the fact that it may not have been selected for display.

TABLE C-1. CONFIG

ITEM	APPLICABILITY	PURPOSE	DESIRED PARAMETER
OUTPUT	All send data and/or receive data output by the D-101	Select whether D-101 will establish interface characteristics of data terminal equipment (DTE) or data control equipment (DCE)	TO MODE TO TERM
CTS DLY	Logical state of CTS (see remarks)	Select CTS delay activity mode as either continuous on or on delayed by 1-255 milliseconds after RTS goes on	0 1-255
RTS	Logical state of RTS (see remarks)	Select RTS activity mode as either continuous on or switched.	ON SW
CD	Logical state of CD (see remarks)	Select CD activity mode as either continuous on or switched.	ON SW
BCC	BCC type (if any) appended to D-101 output messages	Select function disabled (NONE) or select from among: LRC-8, CRC-16, or CCITT as the CRC type that will be appended to the end of messages output by the D-101	NONE LRC-8 CRC-16 CCITT

ATION PARAMETERS (PAGE 3)

REQUIRED KEYSTROKE(S)	REMARKS
Ø 1	This parameter applies only when a Level I or III user program containing one or more output instruction(s) is to be run. "TO MODEM" establishes D-101 interface characteristics of data terminal equipment (DTE); "TO TERMINAL" establishes D-101 interface characteristics of data communication equipment (DCE). If the user program contains no output instructions the "monitor" interface configuration remains in effect regardless of the OUTPUT parameter selection.
Ø or ØØØ Decimal digits of desired "delay" value	This parameter applies only when a Level I or III user program containing one or more output instructions is to be run while the OUTPUT parameter of TO TERM is in effect. With an RTS activity mode of continuous on (zero delay), RTS is at EIA high at all times when Run Program mode and an OUTPUT parameter of TO TERM are in effect. With an RTS activity mode specifying 1-255, CTS high follows detection of RTS high by the specified number of milliseconds and returns to low when actual data output ends.
Ø 1	This parameter applies only when a Level I or III user program containing one or more output instruction(s) is to be run while the OUTPUT parameter of TO MODE is in effect. With an RTS activity mode of continuous on, RTS is at EIA high at all times when Run Program mode is in effect. With an RTS activity mode of switched, RTS is at EIA high only during actual data output by D-101.
Ø 1	This parameter applies only when a Level I or III user program containing one or more output instruction(s) is to be run while the OUTPUT parameter of TO TERM is in effect. With a CD acitvity mode of continuous on, CD is at EIA high at all times when Run Program mode is in effect. With a CD activity mode of switched, CD is at EIA high only during actual data output by D-101.
Ø 1 2 3	This parameter applies only when a Level I or III user program is run and the program contains one or more output instruction(s) with BCC.

APPENDIX D

DISPLAY DETAILS

1. DATA DISPLAY

The D-101 has a full-screen capacity of 160 characters (letters, numbers, and other symbols) displayed in 10 lines of 16 characters each. Data may be displayed on lines 1 through 8; the two bottom lines (9 and 10) are used to display other types of information such as mode and user prompts. Line 10 always indicates the current D-101 operating mode and is termed the "mode line". Screen capacity for data is 128 characters (8 lines x 16 characters per line).

Depending upon the display parameter selected in the configuration table (SND, RCV, or FDX), send data, receive data, or both send and receive data may be displayed. All receive characters are underlined. The screen is filled from left to right, starting at line 1 character 1, and returning to character 1 for each new line. If the SND or the RCV display parameter of the configuration table has been selected, then only the send data or receive data is displayed; all eight lines may display the data. If FDX data is being presented, send data and receive data appear on alternate lines, starting with send data on line 1. Thus, for a full screen of FDX data, the display holds four pairs of alternating send data and receive data lines, with send data appearing on lines 1, 3, 5, and 7 and receive data (underlined) appearing on lines 2, 4, 6, and 8. Send data and receive data characters are displayed in the order in which they are received by the D-101. In FDX mode, if send and receive line data transfer frequencies are essentially equal, then the send-receive display characters normally correspond one-to-one. Possible slight differences between the send line and receive line frequencies may result in the display of a "dummy dot" in a character space on the current display line corresponding to the slower line, while the other current display line is unaffected. However, the character temporarily represented by the dummy dot will not be lost and will be displayed in the character space following the dummy dot. The correspondence of the send data and receive data displays is shifted by one character for each such occurrence.

The D-101 contains an 8K input (capture) buffer that stores up to 4K of send data and 4K of receive data. In RUN MONITOR and RUN PROGRAM modes, data from the external communication line is automatically loaded into the appropriate areas of the input buffer. Upon entry into either Run mode, the input buffer is cleared of any previously stored data, and the incoming data characters are serially loaded into the buffer, starting at the first location in the send data buffer and continuing to fill characters into the buffer at the preselected data transfer rate.

In either Run mode, as data is loaded into the input buffer character-by-character, it is also automatically being loaded into the video (CRT) memory. The originally blank screen (except for MODE=RUN/MON or MODE=RUN/PROG indication on mode line) begins to display the characters (starting at line 1 and filling from left to right as described previously). The display memory capacity is 128 characters (8 lines);

the next character to be displayed after line 8 has been completely filled will appear at the line 1, character 1 space, overwriting the character previously displayed there (display "wraparound" occurs). Beginning with the first occurrence of wraparound, a blank appears in the character space that is immediately in front of the new character to be displayed (i.e. next space on right; or, if the new character is the last one in the line, the blank appears at the beginning of the next line to be started). Two such spaces will occur for a FDX display - one on the send data display line and one on the receive data display line. The blank space described above serves as a demarcation between the oldest data in the video memory (on right side of the blank space) and the newest character added. (Actually, the oldest character is deleted one space ahead of the new character, and then the new character is written.)

In either Run mode (RUN MONITOR or RUN PROGRAM), the running program may be stopped by depressing the STOP key. This invokes the STOP mode (MODE=STOP appears on mode line) and causes a full screen of the most recent on-line data (from the input buffer) to be displayed. Then, using the cursor down (▼), cursor up (▲), PAGE DOWN, and PAGE UP keys, scrolling and paging may be performed to move other areas of the input buffer onto the screen for visual examination. The first 128 characters of the input buffer may be displayed by depressing the HOME key.

Also in either RUN MONITOR or RUN PROGRAM mode, the display (containing the most recent characters, up to 128) can be frozen at any time by depressing the FREEZE key. With the data frozen on the screen, specific characters or other areas of interest may be examined conveniently. However, scrolling, paging, and homing functions (cursor down (▼), cursor up (▲), PAGE DOWN, PAGE UP, and HOME keys) are disabled in this situation. The program continues to run during the time that the display data is frozen, but the display is not updated. A subsequent depression of the FREEZE key unfreezes the display and resumes entry of the current incoming characters into the display.

Characters of 5-, 6-, 7-, or 8-bit lengths can be framed by the D-101. Synchronized incoming characters are displayed at full intensity; unframed data is not displayed. Sync characters and sync reset characters (user-specifiable and selectable as one character or two characters in length each) may be defined automatically by the ROM-based user program or by manual configuration-table entries. If the sync character is detected in the data stream, sync is automatically acquired by the D-101. Once sync is acquired it is maintained until a sync reset character is detected. If for some reason (e.g., sync problem on external communication line) sync is lost, it may be reacquired by depression of the SYN RESET key. It is possible for "false sync" to occur (i.e., synchronization on a "nonintegral" character composed erroneously from adjacent characters in the data stream). If this occurs, the SYN RESET key may be depressed to reset the false sync and reacquire new sync.

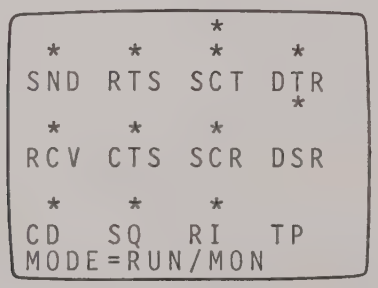
Character parity (odd or even), signal quality, carrier active, RTS, CTS, and the positive or negative transition of a manually selected test point can be recognized by the D-101 as "marker" conditions which will cause the character to be displayed as black on white background ("negative video").

2. LEAD STATE DISPLAY

The Lead State display (see Figure D-1) permits visual monitoring of the states of 11 specified EIA leads (SD, RD, CD, RTS, CTS, SQ, SCT, SCR, RI, DTR, and DSR) plus a twelfth lead that may be selected for monitoring using the TP IN (Test Point In) lead. Any lead that is within EIA specifications may be monitored using the TP portion of the Lead State display by electrically jumpering the lead to the TP IN pin on the interface connector (TEST, MODEM or BUS.MACH. connector pin 11).

The Lead State display may be invoked by depressing the front panel LEAD STATE key when the D-101 is in Command, Run Monitor, Run Program, or Stop mode. Depending upon which mode existed just before the LEAD STATE key was depressed, the mode line (display line 10) may indicate MODE=LEAD STATE (e.g., if entered from Command mode) or MODE=RUN/MON or MODE=RUN/PROG (if entered from Run Monitor or Run Program mode, respectively). For purposes of this discussion, if the Lead State display is on the screen, then the D-101 will be considered to be in Lead State display mode regardless of the mode line indication. If already in Lead State mode, depression of the Lead State key causes the D-101 to return to the mode from which it originally entered the Lead State mode (if this mode was Run Monitor or Run Program) or to the Command mode otherwise. Conditions for entering and exiting the Lead State mode, as well as the corresponding mode line indications, are described in Table E-1.

The LEAD STATE mode has no effect on monitoring or on a user program that may be running while the Lead State display is on the screen (except, possibly, where user program execution is especially time-critical). In the Lead State display, a vertically oriented pair of asterisks located above each lead name (see Figure D-1) indicate whether the lead is "high" (top asterisk lit) or "low" (bottom asterisk lit). The appearance of both asterisks simultaneously indicates that the line is in rapid transition. For all leads except TP, "high" means greater than approximately +2.5 volts and low means more negative than approximately +2.5 volts. The TP lead is calibrated for "high" = more positive than +3.2 volts and "low" = more negative than -3.2 volts.



INTERPRETATION

DSR = EIA HIGH
SCT = CONTINUING RAPID TRANSITIONS
TP = NOT IN USE (AUX CONNECTOR PIN 11 ACCEPTS TP INPUT)
ALL OTHERS = EIA LOW

Figure D-1. Interpretation of Lead State Display

3. COUNTER/TIMER DISPLAY

The D-101 system includes two counters and two timers that may be employed for specific functions in user programs. Each of the counters and timers may be set and used independently of the others. The range of values that can be set into CNTR1 or CNTR2 is Ø to 65535; the range for TIMR1 and TIMR2 is Ø to 65.535 seconds. The minimum non-zero value that can be set is 1 count for the counters and 1 millisecond (00.001 second) for the timers.

Setting of initial counter or timer values is normally included in user-program instructions (refer to the CT instruction in Appendix F for Level I instructions).

The Counter/Timer display may be invoked by depressing the front panel CTR/TMR key when the D-101 is in Command, Run Monitor, Run Program, or Stop mode. Depending upon which mode existed just before the CRT/TMR key was depressed, the mode line (display line 10) may indicate MODE=CNTR/TIMER (e.g., if entered from Command mode) or MODE=RUN/MON or MODE=RUN/PROG (if entered from Run Monitor or Run Program mode, respectively).

If the Counter/Timer display is invoked in Run Program mode, the program will continue to run, but the values of the counters and timers that existed just before the Counter/Timer display was invoked will be displayed (i.e., "frozen" on screen). This has no effect on a running program; during the time that the Counter/Timer display is on the screen, counters and timers continue to function as directed by the program. The display, however, is not updated as the running program accumulates additional counts.

If already in Counter/Timer mode, depression of the CTR/TMR key causes the D-101 to return to the mode from which it originally entered the Counter/Timer mode (if that mode was Run Monitor or Run Program) or to the Command mode otherwise. Conditions for entering and exiting the Counter/Timer mode, as well as the corresponding mode line indications, are summarized in Table E-1.

APPENDIX E

KEYBOARD FUNCTIONS

This appendix is intended as a reference source for all keyboard functions. The operator may use it to acquire general familiarity with the keyboard and to acquaint himself with many possible functions of the keyboard not covered in specific procedures.

The keyboard (Figure E-1), located on the front panel of the unit, is of the membrane type. A total of 32 keys are provided - 16 for entry of hexadecimal digits 0 through F, and 16 for control of specific operating functions. All keys have multiple functions; Table E-1 shows all possible functions for every mode. Circled numerals in the table are used to provide explanatory information too lengthy for inclusion in the table matrix. The key required for interpretation of these numerals is given on the page following this one.

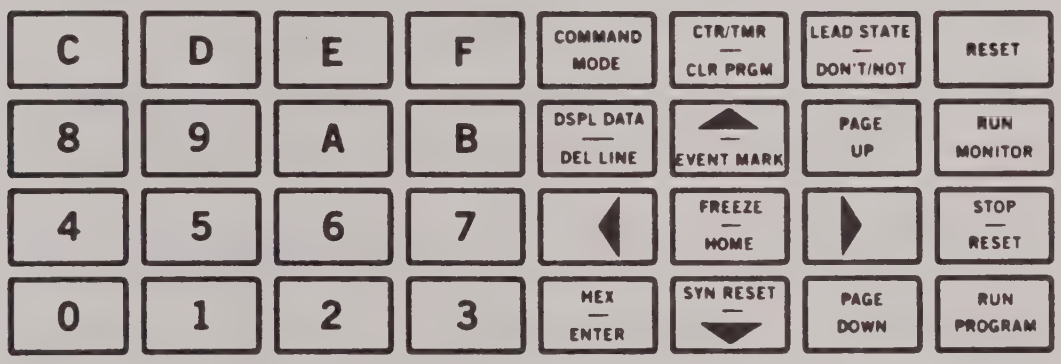


Figure E-1. Front Panel Keyboard

KEY TO CIRCLED NUMERALS

This key provides the interpretation of the circled numerals of Table E-1:

① With a Level III program loaded, keys 0-F may be used for specific functions that the operator can select during some programs.

② After prompters/no prompters has been selected, may be used to enter program steps.

③ Returns D-101 to Command mode, but current display (Counter/Timer or Lead State) remains on screen.

④ If already in Hex mode, returns display to code type previously specified while in Configuration Edit mode.

⑤ May be used to choose between user code and hex (user code default).

⑥ Cursor keys function if program step fields permit.

⑦ Moves cursor down one line (if permitted) or to start of next message.

⑧ When STOP/RESET and RESET keys are depressed concurrently, D-101 is returned to power-up status.

⑨ As used here, "current" refers to data that was previously frozen on screen by depressing STOP/RESET key during Run Monitor or Run Program mode.

⑩ Moves cursor up one line (if permitted) or to last character of previous message.

⑪ Key test value (1C) is not observable. Return of D-101 to Command mode upon depression of the COMMAND MODE key during self-test serves as verification that the key is functioning properly.

⑫ Command mode is automatically entered upon D-101 power-up, and the "mode menu" is displayed. If COMMAND MODE key is depressed while D-101 is in Command mode, no change will occur (mode menu display will remain on screen).

⑬ Returns D-101 to Command mode with "mode menu" appearing on screen.

⑭ D-101 remains in the run mode (Run Monitor or Run Program), but applicable display (Counter/Timer or Lead State) appears on screen. Monitoring or program running continues, although data is not being displayed.

⑮ Invokes Don't/Not function for Match and DF instructions. For Match instruction, one depression activates "no exclude" (dummy dot). For DF instruction, first depression activates "not character" (half intensity), and second depression activates "don't care character" (dummy dot).

⑯ Also provides appropriate message (compiled, error, etc.)

TABLE E-1. KEY FUNC

KEY	KEY TEST VALUE	IMPLIED FUNCTIONS	CMD	RUN/MONITOR	RUN/PROG	STOP	CNTR/TIMER	LEAD S
0	00	0	Invokes Level I Edit mode	No Function	No Function, except in specific program situations (1)	Invokes Level I Edit mode	Invokes Level I Edit mode	Invokes Level I Edit mod
1	01	1	Invokes Page Remark mode	No Function	No Function, except in specific program situations (1)	Invokes Page Remark mode	Invokes Page Remark mode	Invokes Page Rem mode
2	02	2	Invokes Program Load mode	No Function	No Function, except in specific program situations (1)	Invokes Program Load mode	Invokes Program Load mode	Invokes Program mode
3	03	3	Invokes Configuration Edit mode	No Function	No Function, except in specific program situations (1)	Invokes Configuration Edit mode	Invokes Configuration Edit mode	Invokes Configur Edit mod
4	04	4	Invokes Mes- Edit mode (if Level III program resi- dent)	No Function	No Function, except in specific program situations (1)	Invokes Message Edit mode (if Level III pro- gram resident)	Invokes Message Edit mode (if Level III pro- gram resident)	Invokes Message mode (i Level I program
5	05	5	Invokes Option Prom	No Function	No Function, except in specific program situations (1)	No Function	Invokes Command mode (3)	Invokes Command (3
6	06	6	Invokes Option Module	No Function	No Function, except in specific program situations (1)	No Function	Invokes Command mode (3)	Invokes Command (3
7	07	7	Invokes Auto- Config mode	No Function	No Function, except in specific program situations (1)	No Function	Invokes Command mode (3)	Invokes Command (3
8	08	8	Invokes DATA XFR mode	No Function	No Function, except in specific program situations (1)	Invokes DATA XFR mode	Invokes Command mode (3)	Invokes Command (3
9	09	9	No Function	No Function	No Function, except in specific program situations (1)	No Function	Invokes Command mode (3)	Invokes Command (3
A	0A	A	No Function	No Function	No Function, except in specific program situations (1)	No Function	Invokes Command mode (3)	Invokes Command (3
B	0B	B	No Function	No Function	No Function, except in specific program situations (1)	No Function	Invokes Command mode (3)	Invokes Command (3
C	0C	C	No Function	No Function	No Function, except in specific program situations (1)	No Function	Invokes Command mode (3)	Invokes Command (3
D	0D	D	No Function	No Function	No Function, except in specific program situations (1)	No Function	Invokes Command mode (3)	Invoke Command (3

ONS IN ALL MODES

MODE=	EDIT	CONFIG EDIT	MSG EDIT	PGM LOAD	REMARK	ROM	I/O or AUTO-CONFIG or DATA XFR
	Invokes "no-prompt" program listing ②	May be used to change configuration table entries	May be used for selecting a message and also editing the selected message	Selects ROM program directory (invokes ROM mode)	No Function	May be used to select a program	No Function
	Invokes program lising with prompts ②	May be used to change configuratin table entries	May be used for selecting a message and also editing the selected message	Invokes I/O mode	No Function	May be used to select a program	No Function
	Before prompters/no prompters is selected, no function ②	May be used to change configuration table entries	May be used for selecting a message and also editing the selected message	No Function	No Function	May be used to select a program	No Function
n	Before prompters/no prompters is selected, no function ②	May be used to change configuration table entries	May be used for selecting a message and also editing the selected message	No Function	No Function	May be used to select a program	No Function
dent)	Before prompters/no prompters is selected, no function ②	May be used to change configuration table entries	May be used for selecting a message and also editing the selected message	No Function	No Function	May be used to select a program	No Function
e	Before prompters/no prompters is selected, no function ②	May be used to change configuration table entries	May be used for selecting a message and also editing the selected message	No Function	No Function	May be used to select a program	No Function
e	Before prompters/no prompters is selected, no function ②	May be used to change configuration table entries	May be used for selecting a message and also editing the selected message	No Function	No Function	No Function	No Function
e	Before prompters/no prompters is selected, no function ②	May be used to change configuration table entries	May be used for selecting a message and also editing the selected message	No Function	No Function	No Function	No Function
e	Before prompters/no prompters is selected, no function ②	May be used to change configuration table entries	May be used for selecting a message and also editing the selected message	No Function	No Function	No Function	No Function
e	Before prompters/no prompters is selected, no function ②	May be used to change configuration table entries	May be used for selecting a message and also editing the selected message	No Function	No Function	No Function	No Function
e	Before prompters/no prompters is selected, no function ②	May be used to change configuration table entries	May be used for editing selected message	No Function	No Function	No Function	No Function
e	Before prompters/no prompters is selected, no function ②	May be used to change configuration table entries	May be used for editing selected message	No Function	No Function	No Function	No Function
e	Before prompters/no prompters is selected, no function ②	May be used to change configuration table entries	May be used for editing selected message	No Function	No Function	No Function	No Function
e	Before prompters/no prompters is selected, no function ②	May be used to change configuration table entries	May be used for editing selected message	No Function	No Function	No Function	No Function

TABLE E-1. KEY FUNC

KEY	KEY TEST VALUE	IMPLIED FUNCTIONS	MODE = CMD	RUN/MONITOR	RUN/PROG	STOP	CNTR/TIMER	LEA
E	0E	E	No Function	No Function	No Function, except in specific program situations (1)	No Function	Invokes Command mode (3)	Invok Comma
F	0F	F	No Function	No Function	No Function, except in specific program situations (1)	No Function	Invokes Command mode (3)	Invok Comma
HEX	10	HEX	No Function	Converts data display to hex (4)	Converts data display to hex (4)	Converts data display to hex (4)	Invokes Command mode (3)	Invok Comma
ENTER		ENTER	No Function	No Function	No Function	No Function	Invokes Command mode (3)	Invok Comma
SYN RESET	11	SYN RESET	No Function	Initiates acquisition of new sync (with synchronous lines only)	Initiates acquisition of new sync (with synchronous lines only)	No Function	Invokes Command mode (3)	Invok Comma
▼		▼	No Function	No Function	No Function	If data is displayed, moves entire display down one line	Invokes Command mode (3)	Invok Comma
PAGE DOWN	12	PAGE DOWN	No Function	No Function	No Function	If data is displayed, moves entire display down one display page	Invokes Command mode (3)	Invok Comma
RUN PROGRAM	13	RUN PROGRAM	Invokes Run Program mode (if user program has been loaded)	No Function	No Function	Invokes Run Program mode (if user program has been loaded)	Invokes Run Program mode (if user program has been loaded)	Invok Progr (if has
◀	14	◀	No Function	No Function	No Function	No Function	Invokes Command mode (3)	Invok Comma mode
FREEZE	15	FREEZE	No Function	Freezes/unfreezes data display	Freezes/unfreezes data display	No Function	No Function	Invok Comma
HOME		HOME	No Function	No Function	No Function	Rewrites screen, starting with oldest data at upper left corner of screen	Invokes Command mode (3)	Invok Comm mode
▶	16	▶	No Function	No Function	No Function	No Function	Invokes Command mode (3)	Invo Comm mode
STOP	17	STOP	No Function	Stops monitoring and freezes display	Stops program and freezes display	No Function	Invokes Command mode (3)	Invo Comm mode
RESET		RESET	(8)	(8)	(8)	(8)	(8)	

TATE	EDIT	CONFIG EDIT	MSG EDIT	PGM LOAD	REMARK	ROM	I/O or AUTO-CONFIG or DATA XFR
ode	Before prompters/no prompters is selected, no function(2)	May be used to change configuration table entries	May be used for editing selected message	No Function	No Function	No Function	No Function
ode	Before prompters/no prompters is selected, no function(2)	May be used to change configuration table entires	May be used for editing selected message	No Function	No Function	No Function	No Function
ode	Before prompters/no prompters is selected, no function(2)	No Function	(5)	No Function	No Function	No Function	No Function
ode	Before prompters/no prompters is selected, no function(2)	No Function	May be used to get user-selected message number	No Function	No Function	No Function	No Function
ode	No Function	No Function	No Function	No Function	No Function	No Function	No Function
ode	(6)	Moves cursor down if field permits	(7)	No Function	No Function	No Function	No Function
ode	Pages forward one page	Pages forward one page	Displays next page (if permitted) or first page of next message	No Function	Selects page 2 of Remark mode display	Allows paging through multiple-page directories	No Function
un ode program oaded)	No Function	No Function	No Function	No Function	No Function	No Function	No Function
	(6)	No Function	Moves cursor left on char. (if permitted) or to last char. of previous message	No Function	No Function	No Function	No Function
ode(3)	No Function	No Function	No Function	No Function	No Function	No Function	No Function
	(6)	Homes cursor (if field permits)	Homes cursor to line 1, char.1	No Function	No Function	No Function	No Function
	(6)	No Function	Moves cursor right one char. (if permitted) or to first char. in message	No Function	No Function	No Function	No Function
	Invokes Command mode without compiling	Aborts current mode	Aborts editing on current mode	No Function	No Function	No Function	Aborts present mode, returns to CMD mode
(8)	(8)	(8)	(8)	(8)	(8)	(8)	(8)

TABLE E-1. KEY FUN

KEY	KEY TEST VALUE	IMPLIED FUNCTIONS	MOD					
			CMD	RUN/MONITOR	RUN/PROG	STOP	CNTR/TIMER	L
DISPL DATA	18	DISPLAY DATA	Causes current page of data to be displayed (9)	No Function	No Function	No Function	Causes current page of data to be displayed (9)	Cau pag be
DEL LINE		DELETE LINE	No Function	No Function	No Function	No Function	No Function	No
▲ EVENT MARK	19	▲ EVENT MARK	No Function	No Function	No Function	If data is displayed, moves entire display up one line	Invokes Command mode (3)	In mo
			No Function	For each depression, marks current data character in negative video	For each depression, marks current data character in negative video	No Function	Invokes Command mode (3)	No
PAGE UP	1A	PAGE UP	No Function	No Function	No Function	If data is displayed, moves entire display up one display page	Invokes Command mode (3)	In Co mo
RUN MONITOR	1B	RUN MONITOR	Invokes Run Monitor mode	No Function	No Function	Invokes Run Monitor mode	Invokes Run Monitor mode	In Ru mo
COMMAND MODE	1C (11)	COMMAND MODE	No Function (12)	No Function	No Function	(13)	(13)	
CTR/TMR	1D	COUNTER/ TIMER	Invokes Counter/ Timer Display mode	(14)	(14)	Invokes Counter/ Timer Display mode	Invokes Command mode (3)	No
CLR PRGM		CLEAR PROGRAM	No Function	No Function	No Function	No Function	No Function	No
LEAD STATE	1E	LEAD STATE	Invokes Lead State Display mode	(14)	(14)	Invokes Lead State Display mode	No Function	In Co
DON'T/ NOT		DON'T/ NOT	No Function	No Function	No Function	No Function	No Function	No
RESET	1F	RESET D-101	(8)	(8)	(8)	(8)	(8)	

STATE	EDIT	CONFIG EDIT	MSG EDIT	PGM LOAD	REMARK	ROM	I/O or AUTO-CONFIG or DATA XFR
current data to played (9)	No Function	No Function	No Function	No Function	No Function	No Function	No Function
tion	Deletes current line if field permits	Deletes current table entry	No Function	No Function	No Function	No Function	No Function
Command	(6)	Moves cursor up if field permits	(10)	No Function	No Function	No Function	No Function
ction	No Function	No Function	No Function	No Function	No Function	No Function	No Function
	Pages backward one page	Pages backward one page	Displays previous page (if permitted) or last page of previous message	No Function	Selects page 1 of Remark mode display	Allows paging through multiple-page directories	No Function
nitor	No Function	No Function	No Function	No Function	No Function	No Function	No Function
(3)	Attempts to compile program and returns D-101 to Command mode (16)	(13)	(13)	No Function	(13)	(13)	No Function
ction	No Function	No Function	No Function	No Function	No Function	No Function	No Function
ction	Permits option of clearing the program	No Function	No Function	No Function	No Function	No Function	No Function
mode (3)	No Function	No Function	No Function	No Function	No Function	No Function	No Function
ction	(15)	No Function	No Function	No Function	No Function	No Function	No Function
(8)	(8)	(8)	(8)	(8)	(8)	(8)	(8)

APPENDIX F

LEVEL I INSTRUCTION GUIDE

This guide is intended to familiarize the user with Level I instruction definitions and formats and with the procedures for entering the instructions into the D-101.

A level I user program is nothing more than a set of directions that tell the D-101 to perform a specified series of tasks when Run Program mode is invoked. A program "instruction" is the vehicle used to specify a task. A group of instructions that perform a useful series of tasks constitutes a program.

Level I instructions are keyed-in with the D-101 operating in the Edit mode. Instructions are displayed on the CRT as they are keyed in, and the D-101 will not permit entry of syntactically incorrect instructions.

Each instruction occupies one display line; the lines (i.e., program steps) are automatically prenumbered by the D-101. All instructions include a specific instruction mnemonic which identifies the instruction type; the mnemonic is always entered first on the instruction line. In addition, some instructions require entry of one or more parameter fields. The formats of these fields and the order in which they are placed (always to the right of the instruction mnemonic) are fixed for each instruction.

The cursor automatically moves down to the next instruction line immediately upon filling of the required fields(s) of the instruction. When the last instruction line on the screen is filled, the next sequentially numbered instruction line is automatically scrolled up onto the screen, and all other lines are moved up one position. In general, cursor control keys may be used to move the cursor as desired. However, moving the cursor out of an incorrectly entered or incomplete field is not permitted (cursor key functions are disabled if either of those conditions exists).

When all instructions of a program are keyed in, the COMMAND MODE key is pressed to "compile" the "source code" (keyed in by the user) into "object code" (that the microprocessor can execute). If programming errors are detected during the compile process the program line with the error is displayed along with a prompt describing the error. Compiler-detected errors must first be corrected and the COMMAND MODE key then pressed (resulting in a CRT prompt of PROGRAM COMPILED) before the program can be run. If no compiler-detected errors are encountered the program is ready to run.

Program execution begins (program runs) when the RUN PROGRAM key is pressed. Program execution ends (program stops) when an ST (stop) instruction is encountered by the program or when the STOP key is pressed.

All instructions available for use in Level I user programs are listed, and their functions summarized, in Table F-1. More detailed descriptions of these instructions are presented in the remainder of this appendix. The descriptions are arranged in this appendix in the same order in which their instruction mnemonics appear (left-to-right) in the MODE=EDIT instruction prompt. Sample programs illustrating the primary functions you will want to perform (output, trap, count, and time) are presented below.

SAMPLE PROGRAM 1 - OUTPUT A CHARACTER SEQUENCE AND LOOK FOR A RESPONSE

With the D-101 connected as shown in setup 3 of Section 3 and configured as shown in the "SIMULATE DCE" column of Table 4-2, this program will cause the D-101 to:

(1) Simulate DCE (data control equipment).

(2) Output a sequence of characters to a terminal device (in the form of receive data).

(3) Look for the response expected from the terminal device (in the form of send data).

The protocol employed in this example is one commonly employed with many 3270 bi-sync terminals. The character sequence defined by program lines 9 and 10 is an example of a typical poll sequence (from the DCE). The character sequence defined by program line 11 is a typical response (by a terminal) to the poll.

Operation of the program is summarized in the following:

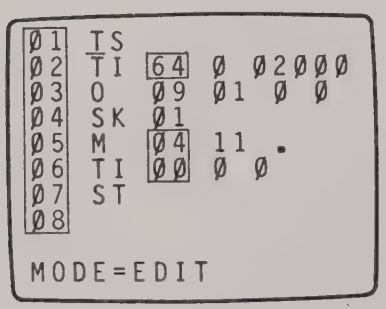
(1) Poll output by D-101.

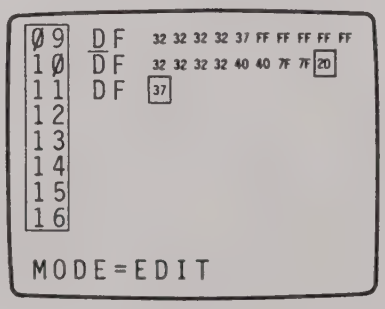
(2) Poll response sought by D-101.

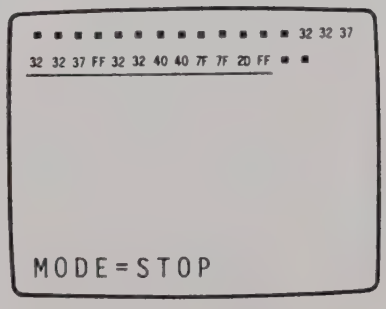
(3) If poll response is detected, it is displayed on the CRT (see third CRT display illustration) and the program terminates.

(4) If poll response is not detected within two seconds, the program terminates with the last three characters of the send line missing.

Note that the poll sequence (program lines 9 and 10), the expected poll response (program line 11), and the wait-for-poll time (02000 milliseconds, program line 2) can be modified to anything that suits your purposes. Also note that the EBCDIC interpretation of hex-pair characters is shown in Appendix H.







SAMPLE PROGRAM 2 - TRAPPING OR MATCHING A CHARACTER SEQUENCE

With the D-101 connected as shown in setup 1 of Section 3 and configured as shown in the "MONITOR" column of Table 4-2, this program will cause the D-101 to:

(1) Monitor a data line.

(2) Evaluate receive data until the occurrence of a specific sequence of characters is detected.

(3) Terminate the program and display the "trapped" sequence of characters (as well as the on-line data that preceded the "trapped" sequence of characters).

The protocol employed in this example is one commonly employed with many 3270 bi-sync terminals. The character sequence defined by program line 06 is compared with a typical general poll.

Operation of the program is summarized in the following:

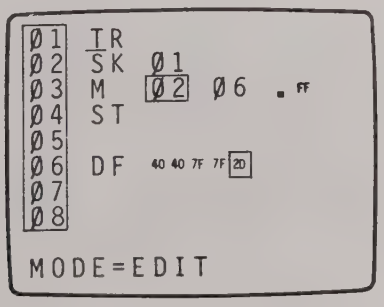
(1) Receive data is selected for evaluation.

(2) One character of receive data is discarded.

(3) The character string defined in program step 06 is compared with on-line receive data.

(4) If the match fails, the "failed" character or characters are discarded and the match process tries again; if the match (of the entire string) succeeds, the program terminates, and the sought character sequence is positioned to the bottom data-display line of the CRT.

Note that send data can be evaluated for the match (instead of receive data) by changing program line 01 to TS and that the character string to be matched (program line 06) can be modified to anything that suits your purposes. Also note that the EBCDIC interpretation of hex-pair characters is shown in Appendix H.



SAMPLE PROGRAM 3 - COUNTING THE OCCURRENCE OF CHARACTER SEQUENCES (OR OTHER EVENTS)

With the D-101 connected as shown in setup 1 of Section 3 and configured as shown in the "MONITOR" column of Table 4-2, this program will cause the D-101 to:

(1) Monitor a data line.

(2) Evaluate receive data until 100 occurrences of a specific sequence of characters are detected.

(3) Terminate the program and display the last "trapped" sequence of characters (as well as the on-line data that preceded the 100th occurrence of the "trapped" sequence of characters).

The protocol employed in this example is one commonly employed with many 3270 bi-sync terminals. The character sequence defined by program line 08 is a typical general poll.

Operation of the program is summarized in the following:

(1) Counter 1 is set to a count of 0.

(2) Receive data is selected for evaluation.

(3) One character of receive data is discarded.

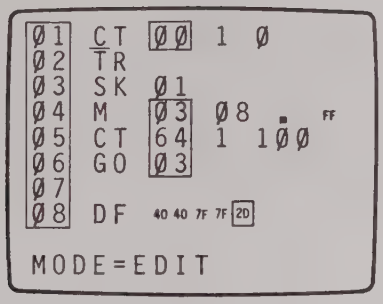
(4) The character string defined in program line 08 is compared with on-line receive data.

(5) If the match fails, the "failed" character or characters are discarded and the match process trys again; if the match (of the entire string) succeeds, counter 1 is incremented by 1 count.

(6) If the count accumulated by counter 1 is less that 100, the match process is repeated; if the count accumulated by counter 1 is 100 the program terminates, and the 100th occurrence of the sought character is recorded on the bottom data-display line of the CRT.

Note that send data can be evaluated for the match (instead of receive data) by changing program line 02 to TS, and the character string to be matched (program line 08) can be modified to anything that suits your purposes. Also note that the counter function can count the ocurrences of any program-defined series of events. This is accomplished by placing a counter instruction in the program flow at the point where all of the conditions required to define the event (or series of events) to be counted have been satisfied. Finally, note that STOP key can prematurely terminate the program and permit the counter display to be read, to determine the number of occurrences of the specified event that have happened up to that time.

The EBCDIC (and ASCII) interpretations of hex-pair characters is shown in Appendix H.



SAMPLE PROGRAM 4 - TIME THE INTERVAL (OF TIME) BETWEEN TWO PROGRAM-SPECIFIED EVENTS

With the D-101 connected as shown in setup 1 of Section 3 and configured as shown in the "MONITOR" column of Table 4-2, this program will cause the D-101 to:

(1) Monitor a data line.

(2) Evaluate receive data until a specific sequence of characters is detected, then start two timers and begin evaluating send data.

(3) Evaluate send data for a period of three seconds or until a specific character is detected (whichever occurs first), then terminate the program and display (on the bottom data-line of the CRT) the on-line data that occurred at the time of program termination (as well as the preceding on-line data).

(4) Time the interval between 2 and 3 above, and store that elapsed time in a timer, thereby enabling the user to invoke the counter/timer display and read the time value.

The protocol employed in this example is one commonly employed with many 3270 bi-sync terminals. The character sequence defined by program line 15 is a typical general poll. The character defined by program line 16 is a typical response, indicating "no data to communicate at this time".

Operation of the program is summarized in the following:

(1) Timer 1 is set to a time of 0.

(2) Counter 1 is set to a count of 0.

(3) Receive data is selected for evaluation.

(4) One character of receive data is discarded.

(5) The character string defined in program line 15 is compared with on-line receive data.

(6) If the match fails the "failed" character or characters are discarded and the match process trys again; if the match (of the entire string) succeeds, the operations described in (7), below are performed.

(7) Timer 1 is set to a maturity value of 60 seconds and is started running. (As timer 1 is used in this program, its maturity value will never be reached.) Interrupt timer 0 is set to a maturity value of 3 seconds and started running. Send data is selected for evaluation, and one character of send data is discarded.

(8) The character defined by program line 16 is compared with on-line send data.

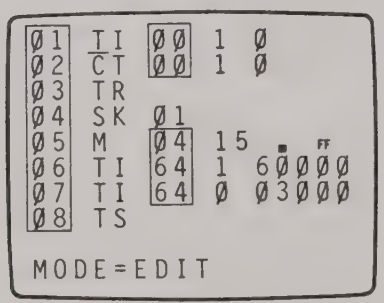
(9) Interrupt timer 0 is running, and if the operations described in (10), below are not completed within three seconds, the program will terminate as described in (11), below.

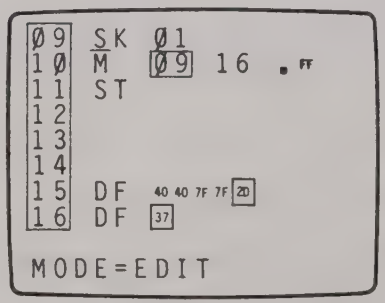
(10) If the match fails, the "failed" character is discarded and the match process trys again; if the match succeeds, the timers are stopped, the program terminates, and the on-line data that occurred at the time of program termination is displayed on the bottom data-line of the CRT. The user can then evaluate the displayed data and/or invoke the counter/timer display. The reading of timer 1 will indicate the time interval between the outgoing poll and the response.

(11) If the program terminates by action of the interrupt timer (which upon reaching maturity value passes program control to program line 64 - an ST instruction), the timers are stopped and the on-line data that occurred at the time of program termination is displayed on the bottom data-line of the CRT. As with (10), above the on-line data can be evaluated and/or the counter/timer display can be invoked; however, counter 1 will read 3 seconds, and the data-display will not show a poll response.

Note that the time interval can be measured between any program-defined event or series of events on either or both sides of the line(send data and receive data). This program is an example of how the function is accomplished.

The EBCDIC (and ASCII) interpretations of hex-pair characters is shown in Appendix H.





Key	Category	Mnemonic	Parameter Field 1
0	CounTer	CT	ENTER BRANCH SEQUENCE NUMBER ØØ-64
1	Define Field	DF	ENTER HEX PAIR OR DONT/NOT K ONCE FOR NOT, TWICE FOR DONT
2	GOto	GO	ENTER BRANCH SEQUENCE NUMBER Ø1-64
3	Match	M	ENTER BRANCH SEQUENCE NUMBER Ø1-64
4	Output	O	ENTER DATA STRING NUMBER Ø1-
5	SKip	SK	ENTER SKIP COUNT 1-65535
6	STop	ST	Not Used
7	TImer	TI	ENTER BRANCH SEQUENCE NUMBER ØØ-64
8	Test Receive	TR	Not Used
9	Test Send	TS	Not Used
A	GoSUB	GS	ENTER BRANCH SEQUENCE NUMBER Ø1-64 ØØ FOR RETURN
B	Reset Stack	RS	Not Used
C	Set Event	SE	Not Used
D	FinD	FD	ENTER HEX PAIR
E	RePeat	RP	ENTER HEX PAIR

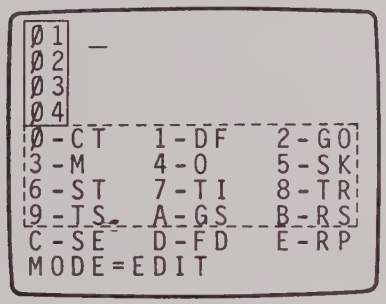
F-1. LEVEL I USER PROGRAM INSTRUCTION SUMMARY

Syntax			Function
Parameter Field 2	Parameter Field 3	Parameter Field 4	
ENTER COUNTER # 1 or 2	ENTER COUNTER OR TIMER TEST COUNT Ø-65535	Not Used	Increments "counter #" (1 or 2) and "branch to" step # (1-64) if this instruction is executed when the accumulated count is equal to "branch on" count (Ø-65535). Otherwise continues with next program step. Branch to ØØ sets counter value to counter entered as parameter 3 of the instruction.
Not Used	Not Used	Not Used	Defines character string referenced by MATCH and/or OUTPUT instructions. Concatenated strings allowed up to source buffer limit (63 lines). All except last line of a multiple-line string must contain ten hex-pairs (characters). Last hex-pair (character) of every string must be marked (in negative video) with ENTER key.
Not Used	Not Used	Not Used	Jumps program control to specified step # (Ø1-64)
ENTER DATA STRING NUMBER Ø1-64	-EXCLUDE CHARACTER- ENTER HEX PAIR OR DONT/NOT KEY FOR NO EXCLUDE	ENTER MATCH MASK	Bit-for-bit ANDs mask character with online char, then compares result with (DF) string char. Jumps to branch sequence # (01-64) if match (compare) fails. Goes to next program step if match succeeds.
ENTER OUTPUT ITERATIONS COUNT Ø1-15 OR C FOR CONTINUOUS	START BCC? Ø - NO 1 - YES	END BCC? Ø - NO 1 - YES	Outputs a data string at referenced step number. Output iterations are continuous or defined by count (C or Ø1-15). BCC generation is optional, and BCC block can embrace any number of DF strings. BCC type and other parameters are defined in configuration table.
Not Used	Not Used	Not Used	Skips (disregards) specified number of send data characters (when TS is in effect) or receive data characters (when TR is in effect), then proceeds with next program step.
Not Used	Not Used	Not Used	Terminates user program. If D-101 is outputting data, also terminates output.
ENTER TIMER # Ø, 1 or 2	ENTER COUNTER OR TIMER TEST COUNT Ø-65535	Not Used	For timer Ø: Sets timer Ø to a maturity value (Ø-65535 milliseconds) and starts it running. Jumps to step number (Ø1-64) when maturity value is reached. Note that an RS instruction must be executed after the jump caused by this instruction if subsequent program flow will encounter a GS-type instruction. For timers 1 & 2: Tests present value of "timer #" (1 or 2), starts it running if not already running, and "branches to" step # (1-64) if present value equals or exceeds specified test value (Ø-65535 milliseconds). Branch to ØØ sets timer to value entered as parameter 3 of the instruction.
Not Used	Not Used	Not Used	Establishes Receive data as source of characters upon which the user program will operate
Not Used	Not Used	Not Used	Establishes Send data as source of characters upon which the user program will operate.
Not Used	Not Used	Not Used	For GS Ø1-64: Jumps program control to specified step # (Ø1-64). Maximum GS nesting level is sixteen. For GS ØØ: This is a RETURN instruction. It jumps program control to first step # after most recently executed GS 01-64 instruction.
Not Used	Not Used	Not used	Resets stack (of return line #'s for GS instructions). Must be executed after a jump caused by a timer Ø instruction if subsequent program flow will encounter a GS-type instruction.
Not Used	Not Used	Not Used	Marks (by negative video, display on the CRT) the send data or receive data character currently being examined by the user prgram.
Not Used	Not Used	Not Used	Ignores all characters until specified character (entered as a hex pair) is found; passes program control to the next program instruction when specified character is found.
Not Used	Not Used	Not Used	Ignores all repeats of the character the program is examining when RD is executed; passes program control to the next program instruction when any other character (entered as a hex pair) is found.

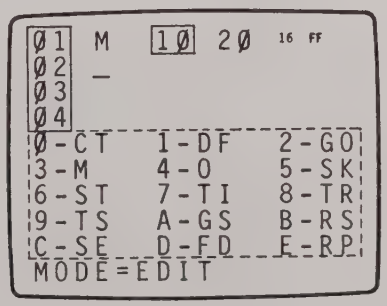
BASIC FUNCTIONS AND FAMILIARIZATION PROCEDURES

In each of the following familiarization procedures, in order to obtain the displays referenced in the procedure, it is assumed that previous program steps have been cleared before the beginning of the new procedure. (Use DEL LINE key to delete instructions individually or use CLR PRGM key to delete program. See Appendix E for DEL LINE and CLR PRGM key function descriptions.) Also, it is assumed that the operator previously opted for prompts when entering the Edit mode from Command mode (see Appendix E).

If no Level I instructions have been entered previously, and the prompts option was chosen, then the Edit mode initial display is as shown in the following screen illustration. The numbers 01 through 04 are program step numbers. The information on the bottom half of the screen (except for line 10) is the instruction mnemonic prompt. (If "no prompts" was chosen, the initial display contains the program step numbers 01 through 08, and the "instruction mnemonics" prompt does not appear.) Meanings and uses of prompts are given in the instruction familiarization procedures. The short line segment in step 01 is the cursor.



Each screen illustration that appears in the familiarization procedures is referenced by a designator in parenthesis. For example, the following screen illustration is designated (F-23).



(F-23)

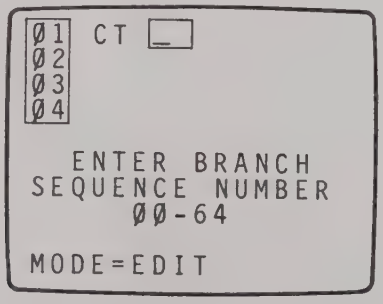
INSTRUCTION: **Counter**
MNEMONIC: **CT**
KEY: **Ø**

BASIC FUNCTIONS: The CT instruction may be used to perform two different, but related, functions. It may be used as a "set-counter" instruction to set a specified counter (counter 1 or counter 2) to any decimal value from 0 to 65,535. Setting the counter to 0 serves to reset the counter. The CT instruction may also be used to perform a "branch-on-condition" function. In this use, the CT instruction increments the counter specified in the instruction (counter 1 or 2) each time it is executed. Then, if the new count is equal to the "branch-on" count specified in the instruction, the CT instruction transfers program flow to another instruction identified by its program step (i.e., instruction line) number, which is specified as a "branch-to" number in the CT instruction. Otherwise (i.e., if the two counts are unequal), no branching occurs (program continues with next instruction following CT instruction). The CT instruction always passes the same data character it received from the previous instruction to the next instruction to be executed. Counters are not automatically reset at the beginning of program runs.

FAMILIARIZATION PROCEDURE:

- To set a counter to a value (or reset a counter):

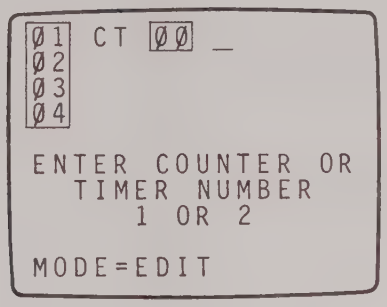
  (a) Depress the Ø key. The CT instruction mnemonic appears, followed by two negative-video blocks with the cursor in the first block (F-1). Any two-digit number in the range ØØ to 64 can be entered in these blocks. This is parameter field 1; for CT instructions it contains the BRANCH SEQUENCE NUMBER (or, "branch-to") field. See prompt on screen. If ØØ is entered, then the counter to be specified in parameter field 2 (not done yet) will be set to the value entered in parameter field 3 (also not done yet) each time the instruction is executed. (If an allowable "branch to" number other than ØØ is entered, then the instruction will behave differently. This will be covered in the "To enter a counter instruction that can cause a branch upon count maturity" procedure.)



(F-1)

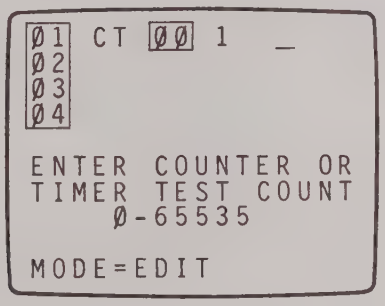
  (b) Depress the Ø key twice. Two zeros appear in the BRANCH SEQUENCE NUMBER field (parameter field 1), and the cursor is automatically positioned two spaces to the right of the last zero (F-2), at parameter field 2. By entering ØØ, the instruction has been identified as a set-counter type. The number of the counter to be used (1 or 2) can now be entered (see

prompt on screen). This will be the only counter affected by the instruction.



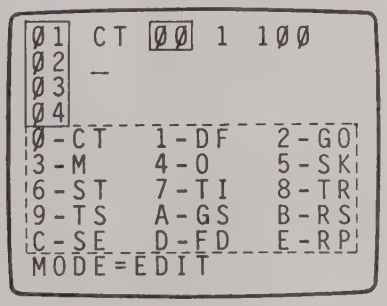
(F-2)

(c) Depress the 1 key. The number 1 appears in parameter field 2, with the cursor automatically positioned two spaces to the right (F-3), at parameter field 3. Counter 1 has been specified. The actual value that the counter is to be set to ("test count") can now be entered (see prompt on screen). The allowable range is 0 to 65535 for either counter selected. (Enter five digits or terminate parameter entry with the Down Arrow key.)



(F-3)

(d) Depress (in order) the 1 key, 0 key, 0 key, and Down Arrow key. The number 100 appears in parameter field 3, and the cursor moves down to the start of the next instruction line (F-4). The counter (counter 1 in this case) will be set to the specified value (100 in this case) each time this instruction is executed by the program.



(F-4)

As mentioned above, either counter can be set to zero using the CT instruction. Since the counters are not automatically reset at the beginning or end of a program

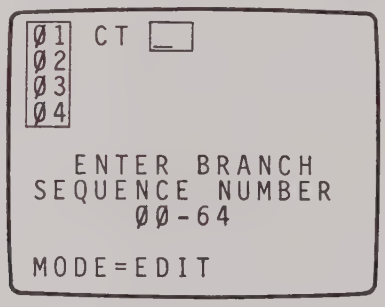
run, the CT instruction must be included in the program to perform this function (if desired) for repetitive program runs, or it must be done manually (using page 4 of the Configuration table) before each separate run.

Note that the instruction mnemonic prompt is now on the screen, and the next instruction may be entered. This prompt will persist even if the cursor is moved up or down, as long as the cursor is kept in the first entry position (instruction mnemonic position) of the line.

NOTE: Counters may also be set (or reset) manually in Configuration Edit mode (see Appendix C). The program cannot distinguish whether a counter value was set manually or by a CT instruction.

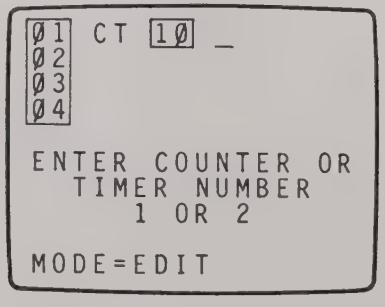
- To enter a counter instruction that can cause a branch upon count maturity:

  (a) Depress the Ø key. The CT instruction mnemonic appears, followed by two reverse-video blocks with the cursor in the first block (F-5). Any two-digit number in the range ØØ to 64 can be entered in these blocks. This is the BRANCH SEQUENCE NUMBER (or, "branch to") field (parameter field 1). See prompt on screen. The value ØØ is entered for CT "set counter" instructions only (described in previous procedure). However, if any number from Ø1 to 64 is entered, then the instruction (when fully entered) will be the branching type of CT instruction. The branching type is described in this procedure.



(F-5)

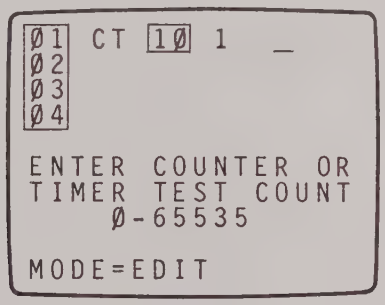
  (b) Depress (in order) the 1 key and Ø key. The number 1Ø appears in the BRANCH SEQUENCE NUMBER field (parameter field 1) and the cursor is automatically positioned two spaces to the right (F-6), at parameter field 2. By entering 1Ø, you have specified step 1Ø as the program step that the program flow will branch to during the CT instruction execution, when the value of the specified counter (not selected yet) reaches the maturity value (not specified yet). Any step from Ø1 to 64 could have been specified.



(F-6)

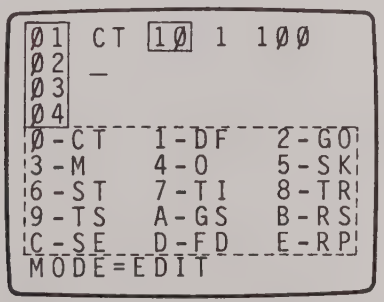
The number of the counter to be used (1 or 2) can now be selected.

(c) Depress the 1 key. The number 1 appears in parameter field 2, with the cursor automatically positioned two spaces to the right (F-7), at parameter field 3. Counter 1 has been specified. The actual value that the counter is to be set to ("test count") can now be entered (see prompt on screen). The allowable range is Ø to 65535 for either counter selected. (Enter five digits or terminate parameter entry with the key.)



(F-7)

(d) Depress (in order) the 1 key, Ø key, Ø key, and Down Arrow key. The number 1ØØ appears in parameter field 3 and the cursor moves down to the start of the next instruction line (F-8). As discussed previously (in set-counter procedure), either of the counters may be set manually (before running program) or by a set-counter CT instruction (during program execution). Starting from the count it was initially set to, the counter will be incremented by 1 each time a "branch-on-condition" instruction, like the one used as an example in this procedure, is executed by the program. Neither counter can be decremented. For branching and/or incrementing to occur, the CT instruction must be executed; if it is in the program but not in the program flow, it will not be executed.



(F-8)

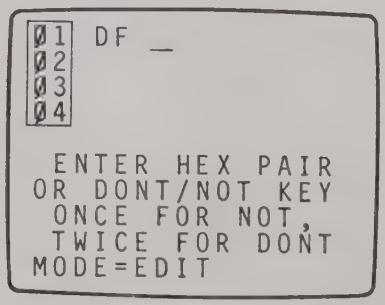
When the counter reaches the value specified in parameter field 3, the program flow is transferred to the program step specified in parameter field 1. In this case, the transfer to program step 10 will occur only when the counter value is 100; for any counter value that is less than or greater than 100, the counter is incremented but no transfer occurs (flow continues to next instruction). Even after a transfer has taken place, if the same CT instruction is encountered again it will increment the counter each time it is executed. If the counter is at 65,535 the attempt to increment will set it to 00000, and subsequent CT executions will increment it in the manner described above.

INSTRUCTION: **Define Field**
MNEMONIC: **DF**
KEY: 1

BASIC FUNCTION: The DF instruction is used to define a character string (i.e., data string). The defined string may be used by a Match (M) instruction or an Output (O) instruction as a referenced data string. If both M and O instructions appear in the same program, they may reference different data strings or the same data string. Each DF instruction may include 1 to 10 characters in its string. DF instructions on successive lines may be concatenated (i.e., joined together) to form one string. The practical maximum length for a concatenated string is 62 lines. (The capacity of the source buffer, or user program memory, is 64 lines, but one line is required for the referencing M or O instruction, and line 64 always contains a Stop (ST) instruction and cannot be used for any other type of instruction.) The end of each DF string must be marked in negative video by depressing the ENTER key. Program execution cannot be started on a DF instruction; attempting to do so results in a compiler error upon depression of the COMMAND key to exit the Edit mode. The DF instruction does not pass characters received from other instructions (character-passing function is not applicable to DF instructions).

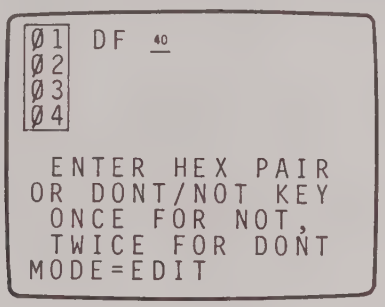
FAMILIARIZATION PROCEDURE:

(a) Depress the 1 key. The DF instruction mnemonic appears, and the cursor is automatically positioned two spaces to the right of the mnemonic, at parameter field 1 (F-9). This is the only field used by the DF instruction; it can be filled with 1 to 10 data characters. See prompt on screen. A hex pair may now be entered to specify the first character in the string. The DONT/NOT portion of the prompt is explained later in this procedure.



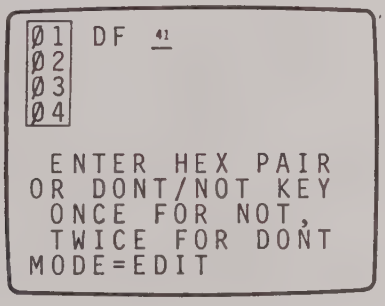
(F-9)

(b) Depress the 4 key. The number 40 appears above the cursor at half-intensity (F-10). (It is at half-intensity because only the first of two key depressions required for entry of the hex pair has been done.)



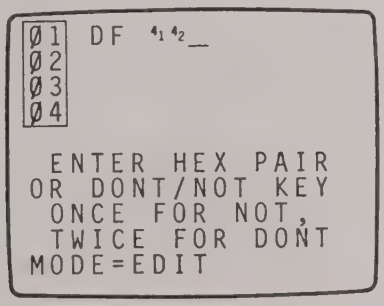
(F-10)

(c) Depress the 1 key. The half-intensity 40 is replaced by the number 41, displayed in full intensity, and the cursor is automatically moved one position to the right (F-11). The change to full intensity signifies that the hex pair entry for that character position has been completed. All hex pairs entered in this fashion actually represent the hex code of the intended character. For example, if the D-101 is configured (by CODE selection in Configuration Edit mode) for ASCII code, the 41 will represent the letter "A" (see Appendix H, Hex-ASCII code conversion chart). Alternatively, the D-101 could be configured for EBCDIC or user code.



(F-11)

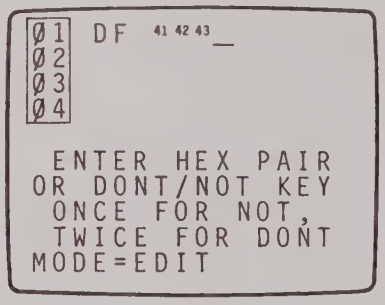
(d) Depress (in order) the 4 key and 2 key. The display (F-12) responds in the same manner as it did in the previous two steps above, except that the number 42 is displayed (full intensity), representing the code for the second character in the data string (e.g., "B" in ASCII).



(F-12)

Note, on the display, that the same prompt has persisted since the DF mnemonic was entered. The prompt indicates that the DONT/NOT key may be used for the NOT function (if depressed once) or the DONT function (if depressed twice). These two functions, which are used with Output (O) and Match (M) instructions, are discussed in the following steps. The actual O and M instructions are discussed in subsequent procedures.

(e) Depress (in order) the 4 key and the 3 key. This enters the number 43 (full intensity). Next, depress the Left Arrow key to reposition the cursor on the 43 just entered. Then, depress the DONT/NOT key once. The number 43 changes to half-intensity. Depress the Right Arrow key. The cursor moves one character position to the right (F-13). By the above actions, the half-intensity character has been designated as a "Not" character.



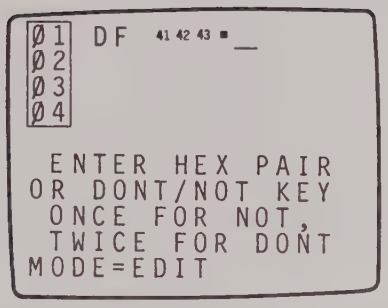
(F-13)

If a DF data string referenced by an Output instruction contains one or more half-intensity "Not" characters, each such character will be output normally whenever the output instruction is executed (i.e., "Not" function has no effect on the output). For example, B, Not C, D will be output as BCD.

If a DF data string referenced by a Match instruction contains one or more "Not" characters, a match will occur, in each case, if the data-stream character encountered is not the specified "Not" character (i.e., a match will not occur if the character is identical to the "Not" character, but will occur for any other type of character). For example, a B, Not C, D data string will not match on BCD in the data stream, but will match on BDD.

The DONT function is discussed in the next step.

(f) Depress the 4 key twice. This enters the number 44 (full intensity). Next, depress the Left Arrow key to reposition the cursor on the 44 just entered. Then, depress the DONT/NOT key twice. The number 44 is replaced by a dummy dot, and the cursor is automatically moved one space to the right (F-14). By the above actions, the character position just entered in the data string has been designated as a "Don't Care" character, which is displayed as a dummy dot.

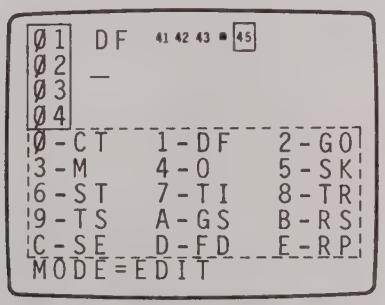


(F-14)

If a DF data string referenced by an Output instruction contains one or more "Don't Care" dummy-dot characters, each such character will be removed from the output. For example, B, Don't Care, D will be output as BD (i.e., dummy dot is removed and no space is inserted in its place).

If a DF data string referenced by a Match instruction contains one or more "Don't Care" dummy-dot characters, a match will occur, for each "Don't Care" character in the string, on any data-stream character encountered (i.e., a match will occur automatically for any DF string position that has a "Don't Care" dummy dot). For example, a B, Don't Care, D data string will match on either BCD or BDD (or any other B-character-D sequence).

(g) Depress (in order) the 4 key and 5 key. This enters the number 45 (full intensity). Next, depress the Left Arrow key to reposition the cursor on the 45 just entered. Then, depress the ENTER key and the Down Arrow key. The number 45 is now displayed in negative video (black-on-white) and the cursor is moved down to the start of the next instruction line (F-15). Repositioning the cursor on the number 45, and depressing the ENTER key marks the 45 (in negative video) as the end of the DF instruction string. The last character in any DF string must be marked in this manner.



(F-15)

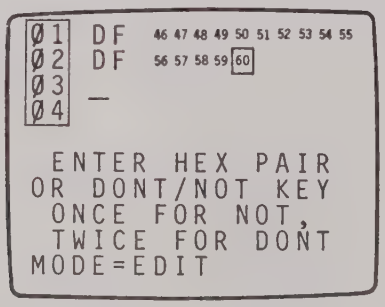
The marked character (or any character in the string) can be replaced with another, if desired, by simply moving the cursor to the character to be replaced and then depressing the two appropriate numbered keys to enter the new character code (the old one is overwritten). An entire line may be deleted by depressing DEL LINE while the cursor is on the line. All program lines may be deleted at once by depressing the CLR PRGRM key and then selecting the "clear program" prompt "yes" choice while still in Edit mode.

(h) Using the DEL LINE key, delete the DF instruction from line Ø1. All instruction lines should be blank, except for the step numbers. Next, using the general method described in previous steps, enter the DF instruction mnemonic (depress the 1 key) and then fill the rest of the line entirely with the character codes 46 through 55 in sequence. (These particular codes are used here for purposes of demonstration; actually, any other codes may be entered instead.) Observe that one DF instruction line holds a maximum of ten character codes. Also note that the cursor moves down to the start of the next line automatically. (It will not move down automatically upon entering a marker, however.)

On line Ø2, enter the DF mnemonic and then the codes 56 through 60 in sequence. Next, move the cursor back to the 60; and then, mark the 60 in negative video by depressing the ENTER key. Depress the Down Arrow key to move the cursor down to the next line (F-16). As a result of the above actions, one data string is produced. The data string in this example starts with the code 46 on line Ø1 and is terminated by the marked code 60 on line Ø2. If the last character in line Ø1 had been marked, the result would have been two separate DF strings. The capability of joining (i.e., concatenating, or stringing) two or more DF instruction data fields is subject to the following restrictions:

(1) Strings greater than 10 characters in length must have 10 characters in each line, except for the last line in the string, which may have fewer characters.

(2) The last line (and only the last line) of the string must be terminated by a marker.



(F-16)

Any attempted output (by O instruction) or match (by M instruction) of a non-data field, or failure to mark the last character of the DF string, or improper stringing of DFs will cause a compiler error indication when the COMMAND key is depressed to exit the Edit mode. Also, attempting to start program execution on a DF instruction will result in an INVALID START ADDRESS compiler error indication (cursor must not be left at DF instruction when exiting Edit mode).

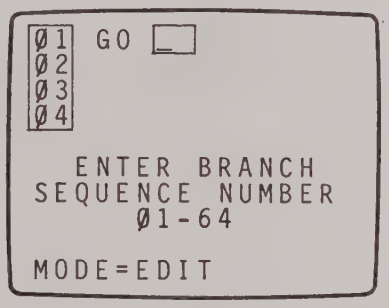
INSTRUCTION: GOto
MNEMONIC: GO
KEY: 2

BASIC FUNCTION: The GO instruction causes an immediate, unconditional transfer of program control (i.e., unconditional jump) to the program step number specified in

the instruction. The range of specifiable step numbers is Ø1 through 64. The GO instruction always passes the character it received from the previous instruction (if any) to the next instruction.

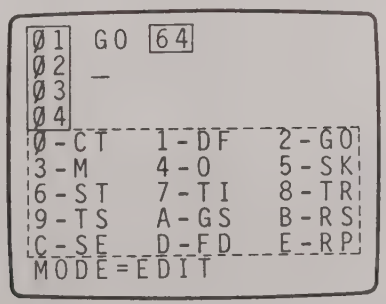
FAMILIARIZATION PROCEDURE:

(a) Depress the 2 key. The GO instruction mnemonic appears, followed by two negative video blocks with the cursor in the first block (F-17). Any two-digit number in the range Ø1 to 64 can be entered in these blocks. This is the BRANCH SEQUENCE NUMBER (or, "branch-to") field, and is the only parameter field (i.e., field 1) in the GO instruction. See prompt on screen. Although any of the program steps may be specified as a "branch-to" number, using Ø1 in this case would not be advisable, since it would create an "endless loop" situation in which nothing useful is accomplished. Also, using Ø2 in this case would serve no useful purpose, since it is not necessary to tell the program to proceed from step Ø1 to step Ø2 (it would do it automatically anyway). Attempting to branch to a data field (line with DF instruction on it) is an invalid instruction sequence and will cause a compiler error indication when the COMMAND key is depressed to exit the Edit mode.



(F-17)

(b) Depress (in order) the 6 key and the 4 key. The number 64 appears in parameter field 1 (in negative video), and the cursor automatically moves down to the start of the next instruction line (F-18). By the above actions, program step 64 has been specified as the step that the program will unconditionally jump to when the GO instruction is executed. The number used in this example (64) is a special case. Program step 64 always contains a Stop (ST) instruction (automatically inserted) which, when executed, stops program execution. For this reason, 64 should be used in the "branch-to" field only when the intention is to use the GO instruction to stop program execution immediately.



(F-18)

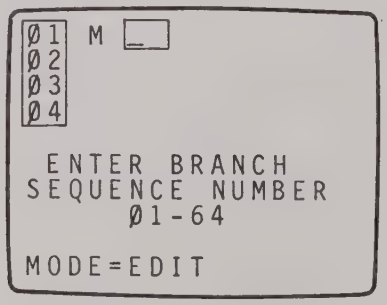
INSTRUCTION:	**Match**
MNEMONIC:	**M**
KEY:	**3**

BASIC FUNCTION: The M instruction tests for matching of data-stream character patterns with a referenced data string (DF field). The testing is performed on a character-by-character basis. If any individual character match fails, program control is transferred to the program step specified as the branch sequence number in the M instruction (jump occurs). If the match is successful for the entire DF data string, no jump occurs and the instruction in the next sequential program step is executed. The rules for matching are modified for any "Not" or "Don't Care" characters that may appear in the referenced DF string (see DF instruction procedure). The rules are also modified for the "mask" character that appears in the instruction itself. For a "Not" character, a match will occur on any data-stream character encountered except the specific "Not" character; for a "Don't Care" character, a match will occur on any data-stream character at all; for a "mask" character, its 1s bits define which bits (of online character versus DF character) must coincide to effect a match. The M instruction itself can exclude a character from the match (i.e., cause the character to be ignored). The "exclude" character (if used) is specified in the next-to-last parameter field of the M instruction. The "mask" character is specified in the last parameter field of the instructions.

On a mismatch, the M instruction passes the character it received from the previous instruction to the next instruction to be executed. On a match, no character is passed. Regardless of the number of consecutive matches, the M instruction always passes the first character that doesn't match. However, if the DF string is completely matched, the instruction passes the last data-stream character matched in the DF string.

FAMILIARIZATION PROCEDURE:

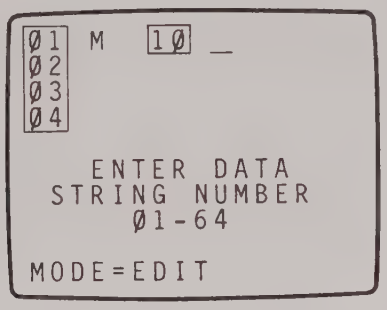
(a) Depress the 3 key. The M instruction mnemonic appears, followed by two reverse-video blocks with the cursor in the first block (F-19). Any two-digit number in the range Ø-64 can be entered in these blocks. This is the BRANCH SEQUENCE NUMBER (or, "branch-to") field (parameter field 1). See prompt on screen.



(F-19)

(b) Depress (in order) the 1 key and the Ø key. The number 1Ø appears in the BRANCH SEQUENCE NUMBER field, and the cursor is automatically positioned two spaces to the right of the entered number (F-20). This is the DATA STRING NUMBER field (parameter field 2). By the above actions, program step 1Ø has been specified as the step to which program control will be transferred for any occurrences of mismatches during M instruction execution. It should be noted that, since step 64 always contains a Stop instruction, specification of 64 as the "branch-to" number will cause the

program to stop immediately upon a mismatch. Also, 00 is an invalid "branch-to" number.



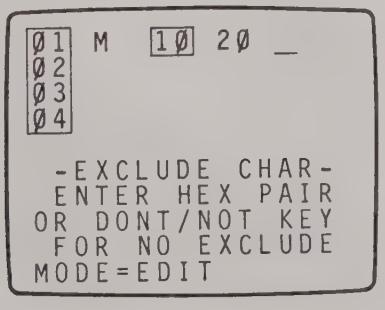
(F-20)

As indicated by the prompt, the step number of the data string to be referenced can now be entered.

(c) Depress (in order) the 2 key and the 0 key. The number 20 appears in the DATA STRING NUMBER field, and the cursor is automatically positioned two spaces to the right of the entered number (F-21). This is the EXCLUDE CHARACTER field (parameter field 3). By the above actions, the program step number of the DF string to be referenced by the M instruction has been specified. The DF string is entered as a separate instruction (see DF instruction). The following should be noted when entering an actual program:

(1) The Step referenced by the data string number must contain a DF string; otherwise a compiler error will result upon depression of the COMMAND key to exit the EDIT mode.

(2) The referenced DF string may be physically located in a program step that is higher or lower in number than the M instruction step number, although it is more natural to locate the DF string after the M instruction. However, as mentioned in the DF instruction procedure, program execution cannot be started on the DF instruction (results in compiler error).

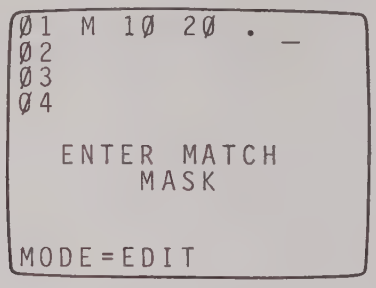


(F-21)

As indicated by the prompt, an exclude character (hex pair) may now be entered or alternatively, the DONT/NOT key may be used to opt for "no exclude character".

(d) If you press the DONT/NOT key once, a "dummy dot" appears in the EXCLUDE CHARACTER field, and the cursor is moved to the start of the mask-character field (F-22). By this action the "exclude character"

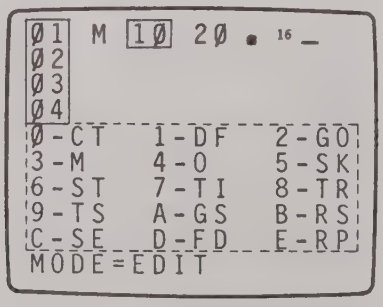
function has been disabled for the M instruction being entered. Alternately, if the program requires an "exclude" character of "Sy" (hex 16) for example, depress (in order) the 1 key and the 0 key. The hex character "16" will appear (instead of the dummy dot shown in F-22), "Sy" is entered as the "exclude character, and the cursor is moved to the mask-character, and the cursor is moved to the mask-character field (F-22).



(F-22)

The exclude character defined in the M instruction is always excluded from the match test, regardless of the frequency of occurrence of the character in the data stream. In effect, the character is ignored by the M instruction. If the exclude character does not appear in the referenced DF string, it is necessary to match only the non-excluded characters for a match to occur. However, if the exclude character appears in the DF string, it may be impossible for a complete match to ever occur for the string. For example, DF 16 16 41 with 41 specified as the exclude character code in the M instruction will always result in a mismatch, regardless of the data stream character sequence, because the 41 in the DF string can never be matched (any 41 occurring in the data stream will be excluded before the match can occur). Similar failures to match are likely to result even if the exclude character appears as "Don't" or "Not" character in a referenced DF string. Therefore, a character designated as an exclude character in an M instruction should not be included in the referenced DF string.

(e) Depress the F key twice. By this action a mask character (hex pair) of FF is entered and the cursor is moved to the start of the next instruction line (F-23).



(F-23)

During program operation the online character is bit-for-bit ANDed with the mask character, and the result is compared with the appropriate character of the DF field. If a true comparison results, program execution jumps to the step specified in the match instruction. If a false compare results, program execution continues with the next sequential instruction. Note that a false compare will result if a "1" bit appears in the same bit position of the DF character that a "0" bit appears in the mask.

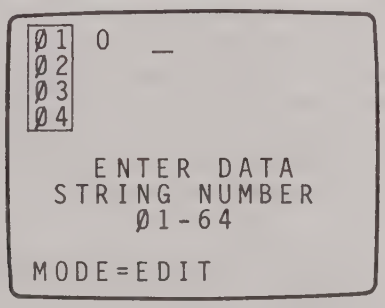
INSTRUCTION: Output MNEMONIC: O KEY: 4

BASIC FUNCTION: The O instruction outputs a referenced data string (DF field). The data string is referenced in the O instruction by program step number, and may be output continuously or for a specified number of iterations in the range of 1 to 15 times.

The O instruction allows the option of starting Block Check Character (BCC) generation (yes or no) and also, the option of ending BCC generation (yes or no). (For BCC types, see Configuration Edit mode parameters in Appendix C.) Although a single O instruction can reference only one DF field, the BCC block can be extended to include more than one (or, possibly, all) of the DF fields in the program. This is done by starting the generation of the BCC with one O instruction and ending generation of the BCC with the O instruction that references the last DF field to be included in the output message. The O instruction always passes the character it received from the previous instruction to th next instruction.

FAMILIARIZATION PROCEDURE:

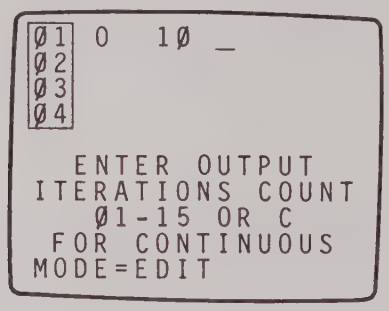
(a) Depress the 4 key. The O instruction mnemonic appears, and the cursor is automatically positioned two spaces to the right of the mnemonic, at parameter field 1 (F-24). This is the DATA STRING NUMBER field. As indicated by the prompt, any data string number in the range of Ø1 to 64 may now be entered.



(F-24)

(b) Depress (in order) the 1 key and the Ø key. The number 1Ø appears in the DATA STRING NUMBER field, and the cursor is automatically positioned two spaces to the right of the 1Ø, in parameter field 2 (F-25). By the above actions, program step 1Ø has been specified as the step that contains the data string to be output upon execution of this O instruction (i.e., the "referenced data string" has been identified by its step number). For actual programs, a DF string must be entered at this step number. The DF string is entered as a separate instruction (see DF instruction). In this example, the DF instruction must be located at step 1Ø. If the specified step does not contain a DF string, then an ATTEMPTED OUTPUT OF

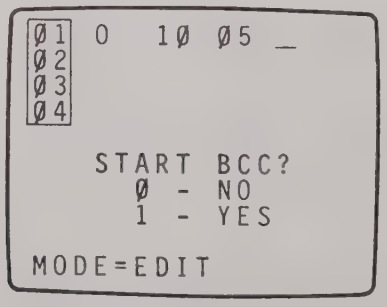
NON-DATA FLD INSTRUCTION compiler error will result upon depression of the COMMAND key to exit the Edit mode. For a two-line or multiline concatenated data string, any of the lines in the string may be referenced. If this is done, the O instruction will output only a portion of the string, starting from the specified step number and ending with the last character in the overall string: no error will occur in this case.



(F-25)

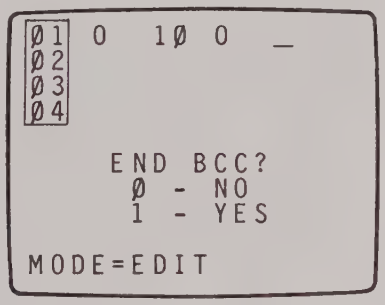
As indicated by the prompt, the output iterations count may now be specified, or continuous output may be selected. These options are discussed next.

(c) Depress (in order) the 0 key and the 5 key. The number 05 appears in parameter field 2, and the cursor is automatically positioned two spaces to the right of the 05, in parameter field 3 (F-26). By the above actions, the output iterations (i.e., total number of times the O instruction is to output the referenced string for one pass through this O instruction) has been specified as 5 times. The allowable range of iterations is 1 to 15. If the C key had been depressed instead of the 0 key and the 5 key, then continuous output would have been selected. Only one depression of the C key is necessary to complete the entry in parameter field 2, instead of the two key depressions required for entry of an iterations count value. When the C key is depressed, the character C appears in the first space of parameter field 2, and the cursor automatically moves three spaces to the right of the C, to parameter field 3. With continuous output selected, the referenced data string will be output continuously while the program is running.



(F-26)

(d) An entry must now be made to specify whether BCC generation should be started on the output data of this O instruction (i.e., with the first character of the referenced DF string). As indicated by the prompt, entry of a Ø specifies "do not start BCC", and entry of a 1 specifies "start BCC". Depress the 1 key. The number 1 appears in the START BCC field (parameter field 3), and the cursor is automatically positioned two spaces to the right of the 1, in parameter field 4 (F-27). By the above action, the "start BCC" option has been selected for this O instruction. With BCC generation in effect, a BCC based on the output data is accumulated by the D-101 and appended at the end of the stream of output data (i.e., at end of block or message). The BCC may be used by receiving equipment for automatic detection of data transfer errors (e.g., occurrences of "dropped bits"). One of three alternative types of BCCs can be used by the D-101. The particular type chosen during BCC selection in Configuration Edit mode is in effect for all data output involved in the BCC generation.



(F-27)

(e) An entry must now be made to specify whether BCC generation should be ended on the output data of this text omitted character of the referenced DF string). As indicated by the prompt, entry of a Ø specifies "do not end BCC", and entry of a 1 specifies "end BCC". Depress the Ø key. A Ø appears in the END BCC field (parameter field 4), and the cursor automatically moves down to the start of the next instruction line (F-28). The above action, has implemented the choice to not end BCC generation on this O instruction. (In an actual program, another O instruction with only the "end BCC" option chosen would be needed to end the BCC generation started by this O instruction. Alternatively, the parameters of an O instruction may be selected to start or end BCC generation, to do both, or to do neither.)

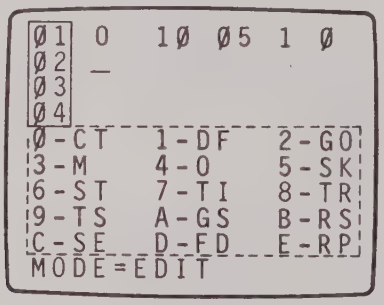
The following O instruction operational characteristics should be noted:

- Since step 64 always contains a Stop instruction, the program will be stopped immediately upon execution of step 64. For this reason, the program should include at least one branching instruction between the O instruction step and step 64 to prevent the program from being stopped before the desired outputting is completed by the O instruction. The GO instruction may be used, for example, to unconditionally "branch away" from step 64, and thus keep an O instruction (with continuous output selected) repetitively outputting data for an indefinite period of time. A Match (M), counter (CT), or Timer (TI) instruction may be used to branch (or drop through) to the Stop instruction upon fulfillment of a desired condition (e.g., matched string, maturity of count, or timeout) and thereby halt outputting.

- Although a program continues executing its other instructions essentially independently during outputting by an O instruction, a second O instruction entered further down in the program flow will "wait" until the first O instruction has been completely executed. If the first O instruction is the continuously outputting type, the second one will never be executed.

- To start or end BCC generation, an O instruction containing the appropriate parameter entries must be actually executed.

- Program flow must not progress to, or loop back to, an O instruction that specifies "start BCC" before ending a previously started BCC generation. Also, an O instruction that specifies "end BCC" must not be executed without previously starting BCC generation.



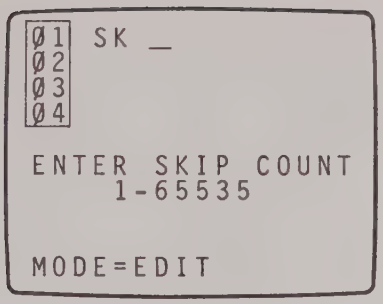
(F-28)

INSTRUCTION: **Skip**
MNEMONIC: **SK**
KEY: **5**

BASIC FUNCTION: The SK instruction skips (i.e., disregards) a specified number of data characters (range 1 to 65,535) specified in SK instruction and then allows the program to proceed to the next program step. The SK instruction passes to the next instruction the first "non-skip" character encountered in the data stream. This is always the nth character after the character received by the SK instruction from the previous instruction, where n is the specified number of characters to be skipped. For example, if a skip count of 16 is specified in the SK instruction, then the SK instruction will pass to the next instruction the 16th data-stream character encountered after receiving a passed character from the previous instruction. The SK instruction discards the character passed to it.

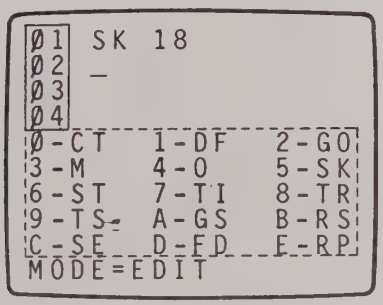
FAMILIARIZATION PROCEDURE:

(a) Depress the 5 key once. The SK instruction mnemonic appears, and the cursor is automatically positioned two spaces to the right of the mnemonic, at parameter field 1 (F-29). This is the SKIP COUNT field, and is the only parameter field used by the SK instruction. As indicated by the prompt, any skip count in the range of 1 to 65,535 characters may be entered.



(F-29)

(b) Depress (in order) the 1 key, 8 key, and Down Arrow key. The number 18 appears in parameter field 1, and the cursor moves down to the start of the next instruction line (F-30). By the above actions, the skip count has been specified as 18. If this particular SK instruction is executed in a program, it will skip (i.e., ignore) 18 consecutive data characters, and then allow the program to proceed to the next program step. Note that it was necessary to use the Down Arrow key to move the cursor down after completing instruction entry.



(F-30)

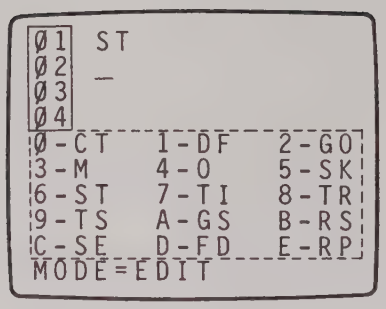
See prompt on screen. If desired, the next instruction may now be entered.

```
INSTRUCTION: Stop
MNEMONIC:  ST
KEY:  6
```

BASIC FUNCTION: The ST instruction terminates user program execution, stops program timers, and also halts loading of the input buffer. (Timers and input buffer are discussed elsewhere in this manual.)

FAMILIARIZATION PROCEDURE:

(a) Depress the 6 key once. The ST instruction mnemonic appears, and the cursor moves down to the start of the next instruction line (F-31).



(F-31)

(b) See prompt on screen. Since the ST instruction has no parameters, only one key depression was required to enter it. If desired, the next instruction may now be entered.

INSTRUCTION: **Timer**
MNEMONIC: **TI**
KEY: **7**

BASIC FUNCTIONS: The TI instruction actually encompasses two different, but functionally related, types of instructions. The Timer Ø TI instruction controls D-101 interrupt timer Ø (implemented in hardware) and hence is referred to as the "interrupt timer" instruction. The other type of TI instruction can employ timer 1 or timer 2 (implemented in software). Essentially, both types of TI instruction can be used to set the applicable timer to a maturity value (in units of milliseconds), and also, to effect a jump to a specified step number when the timer reaches the maturity value (i.e., times out). Timer Ø, timer 1, or timer 2 may be set to any value from Ø to 65,535 milliseconds. Setting timer 1 or timer 2 to Ø serves to reset the timer. The TI instruction passes the same character it received to the next instruction to be executed.

Specific charactertics of the two basic types of TI instruction are as follows:

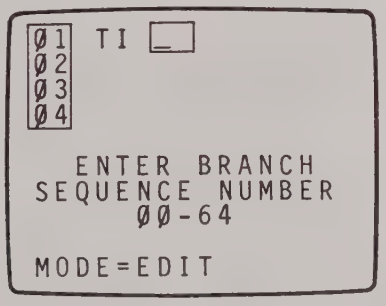
- When the Timer Ø instruction executes before the specified maturity value has been reached in timing, it causes hardware interrupt timer Ø to be set to the TIMER TEST COUNT (i.e., maturity value) specified in the instruction and then starts the timer running from zero. (If timing was already in progress, this is actually an interruption of time count, a reestablishment of maturity value, and subsequent restart of timing from zero.) However, if timer Ø is allowed to time out (i.e., to reach maturity value), the Timer Ø instruction causes an immediate jump to the program step specified in the instruction (range Ø1 to 64). An RS instruction must be executed after the jump to clear the GoSUB stack if a GS or Return (GS ØØ) instruction is included in subsequent program flow (see RS and GS instruction descriptions for information on stack and subroutine returns).

- A Timer 1 or Timer 2 TI instruction may be used to set timer 1 or timer 2 to any value from 0 to 65,535 millseconds and simultaneously start the timer running (if it is not already running); or, to perform a "branch-on-condition" function. The branching type of TI instruction tests the present value

(elapsed time) of the timer specified in the instruction (timer 1 or 2). If the value is greater than or equal to the maturity value ("branch-on" value) specified in the instruction, the TI instruction transfers program flow (i.e., jumps) to another instruction identified by its program step number, which is specified as a "branch-to" number in the TI instruction. Otherwise (i.e., if the present value of the timer is less than the maturity value specified in the instruction), no branching occurs (program continues with next instruction following TI instruction). The timer indicates elapsed time in milliseconds during the time that the program is running. A timer cannot be used to count down toward zero, but does revert to Ø milliseconds (and continues timing from there again) if permitted to run past 65,535. Execution of the Stop (ST) instruction terminates timing, but does not reset the timers to zero.

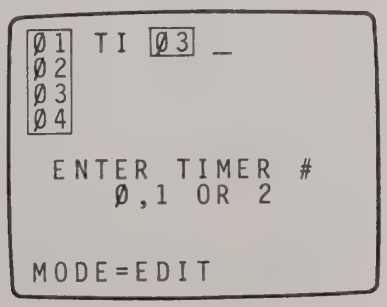
FAMILIARIZATION PROCEDURE (Timer Ø Instruction):

(a) Depress the 7 key once. The TI instruction mnemonic appears, followed by two negative-video blocks with the cursor in the first block (F-32). Any two-digit number in the range ØØ to 64 can be entered in these blocks. For TI instructions, parameter field 1 is the BRANCH SEQUENCE NUMBER (or, "branch to") field. See prompt on screen. For the Timer Ø instruction, the entry ØØ in this field is used only in the special-case Timer Ø instruction termed the "stop interrupt timer" instruction. Entry of this type of Timer Ø instruction is discussed in more detail below. For the general, or "normal" Timer Ø instruction, values in the range Ø1 to 64 must be entered in this field.



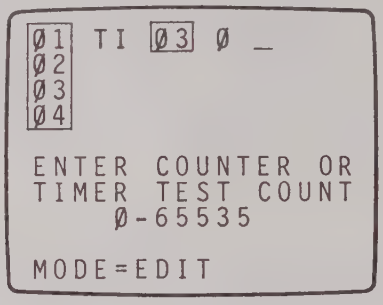
(F-32)

(b) Depress (in order) the Ø key and the 3 key. The value Ø3 appears in parameter field 1 and the cursor is automatically positioned two spaces to the right of the 3, at parameter field 2 (F-33). The "branch-to" step has been specified as program step Ø3. See prompt on screen. The number of the timer to be used (Ø in this case) can now be entered.



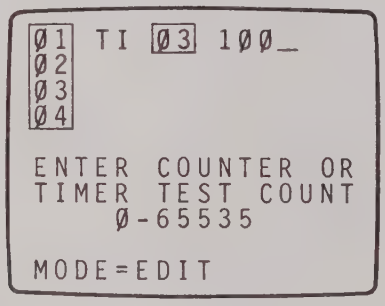
(F-33)

(c) Depress the Ø key. A Ø appears in parameter field 2 and the cursor is automatically positioned two spaces to the right, at parameter field 3 (F-34). By this action, timer Ø has been selected, and this TI instruction has been identified as a Timer Ø instruction. Timer Ø will be the only timer affected by execution of this instruction. See prompt on screen. The maturity value (i.e., TIMER TEST COUNT) must now be entered to complete the instruction.



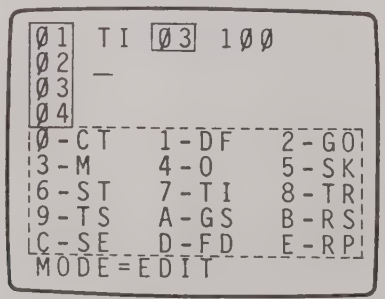
(F-34)

(d) Depress (in order) the 1 key, Ø key, and Ø key. The number 1ØØ appears in parameter field 3 and the cursor is now positioned one space after the 1ØØ (F-35). The number 1ØØ has been entered, but the correponding maturity value (100 milliseconds) has not yet been specified, since the field has not yet been completed.



(F-35)

(e) To complete specification of the maturity value, and entry of this instruction, depress the Down Arrow key. The cursor is moved down to the start of the next instruction line (F-36). As indicated by the prompt, the next instruction may now be entered. It should be noted that depression of the Down Arrow key to complete the instruciton is not necessary when all 5 digits of parameter field 3 are filled. (The cursor automatically moves down to the next instruction line upon entry of the fifth digit.) The cursor will move down automatically if a maturity value of 10,000 milliseconds or higher is entered, or if leading zeros are entered for smaller maturity values (e.g., if ØØ1ØØ is entered instead of 1ØØ).



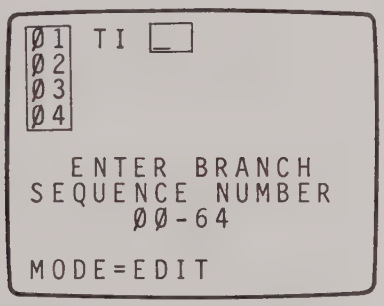
(F-36)

Entry of the special-case "stop interrupt timer" Timer Ø instruction is slightly different from the Timer Ø instruction entry described in the above procedure. If ØØ has already been entered in parameter field 1, then, upon entry of timer number Ø in parameter field 2, another Ø will automatically appear in parameter field 3, and the cursor will automatically move down to the next instruction line. (It is not possible to specify a maturity value in this type of Timer Ø instruction.)

FAMILIARIZATION PROCEDURE (Timer 1 or Timer 2 Instruction):

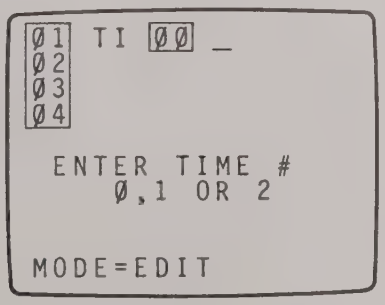
- To set a timer to a value (or reset a timer):

  (a) Depress the 7 key once. The TI instruction mnemonic appears, followed by two negative-video blocks with the cursor in the first block (F-37). Any two-digit number in the range ØØ to 64 can be entered in these blocks. For TI instructions, parameter field 1 is the BRANCH SEQUENCE NUMBER (or, "branch-to") field. See prompt on screen. If ØØ is entered, the timer to be specified in parameter field 2 (not done yet) will be set to the value entered in parameter field 3 (also not done yet) each time the instruction is executed. (If an allowable "branch-to" number other that ØØ is entered, the instruction will behave differently. This will be covered in the "To enter a timer instruction that can cause a program branch" procedure.)



(F-37)

  (b) Depress the Ø key twice. Two zeros appear in the BRANCH SEQUENCE NUMBER field (parameter field 1), and the cursor is automatically positioned two spaces to the right of the last zero (F-38), at parameter field 2. By entering the ØØ, the instruction has been identified as a set-timer type. The number of the timer to be used (1 or 2) can now be entered (see prompt on screen). This will be the only timer affected by the instruction.



(F-38)

(c) Depress the 1 key. The number 1 appears in parameter field 2, with the cursor automatically positioned two spaces to the right (F-39), at parameter field 3. Timer 1 has been specified. The actual value that the timer is to be set to ("test count") can now be entered (see prompt on screen). The allowable range is Ø to 65535 millseconds for either timer selected. (Enter five digits or terminate parameter entry with the down arrow key.)

```
Ø1  TI ØØ 1 _
Ø2
Ø3
Ø4

ENTER COUNTER OR
TIMER TEST COUNT
     Ø-65535

MODE=EDIT
```

(F-39)

(d) Depress (in order) the 1 key, Ø key, Ø key, and Down Arrow key. The number 1ØØ appears in parameter field 3, and the cursor moves down to the start of the next instruction line (F-40). **(Note:** See description of maturity value entry in Timer Ø FAMILIARIZATION PROCEDURE for information on automatic cursor advancement to next instruction line.) The timer (timer 1 in this case) will be set to the specified value (100 millseconds in this case) each time this instruction is executed by the program.

```
Ø1  TI ØØ 1 1ØØ
Ø2  _
Ø3
Ø4
Ø-CT   1-DF   2-GO
3-M    4-O    5-SK
6-ST   7-TI   8-TR
9-TS   A-GS   B-RS
C-SE   D-FD   E-RP
MODE=EDIT
```

(F-40)

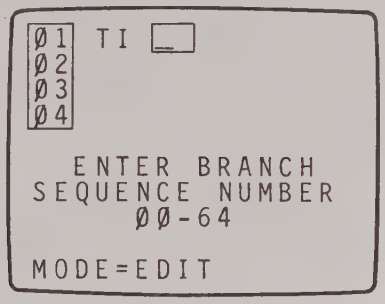
As mentioned above, either timer can be set to zero using the TI instruction. Since the timers are not automatically reset at the beginning or end of a program run, the TI instruction must be included in the program to perform this function (if desired) for repetitive program runs, or it must be done manually (using page 4 of the Configuration table) before each separate run. A running program cannot distinguish whether a timer value was set manually or by a TI instruction.

Note that the instruction mnemonic prompt is now on the screen, and the next instruction may now be entered.

- To enter a timer instruction that can cause a program branch:

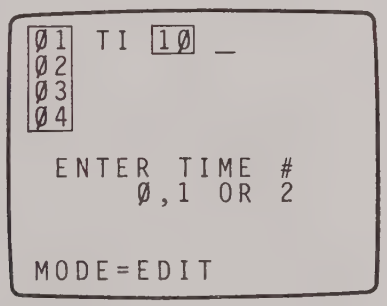
(a) Depress the 7 key. the TI instruction mnemonic appears, followed by two negative-video blocks with the cursor in the first block (F-41). Any two-digit number in the range ØØ to 64 can be entered in these blocks.

This is the BRANCH SEQUENCE NUMBER (or, "branch-to") field (parameter field 1). See prompt on screen. The value ØØ is entered for TI "set-timer" instructions only (described in previous procedure). However, if any number from Ø1 to 64 is entered, then the instruction (when fully entered) will be the branching type of TI instruction. The branching type is described in this procedure.



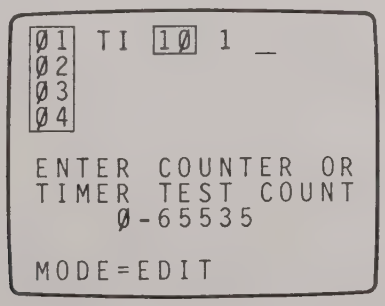
(F-41)

(b) Depress (in order) the 1 key and the Ø key. The number 1Ø appears in the BRANCH SEQUENCE NUMBER field (parameter field 1), and the cursor is automatically positioned two spaces to the right (F-42), at parameter field 2. Entering 1Ø specifies step 1Ø as the program step to which the program flow will branch during the TI instruction execution when the value of the specified timer (not selected yet) reaches or exceeds the test count (not specified yet). Any step from Ø1 to 64 could have been specified. The timer to be used (timer 1 or 2) can now be selected.



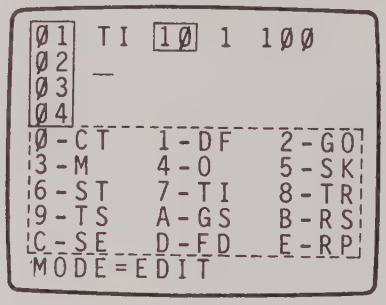
(F-42)

(c) Depress the 1 key. The number 1 appears in parameter field 2, with the cursor automatically positioned two spaces to the right (F-43), at parameter field 3. Timer 1 has been specified. The actual value that the timer is to be set to ("test count") can now be entered (see prompt on screen). The allowable range is 65535 millseconds for either timer selected. Enter five digits or terminate parameter entry with the key.



(F-43)

(d) Depress (in order) the 1 key, Ø key, Ø key, and Down Arrow key. The number 1ØØ appears in parameter field 3, and the cursor moves down to the start of the next instruction line(F-44). (Note: See description of maturity value entry in Timer Ø FAMILIARIZATION PROCEDURE for information on automatic cursor advancement to next instruction line.) As described previously (in set-timer procedure), either timer may be set manually (before running program) or by a set-timer TI instruction. Once activated by the "branch-to" TI instruction, like the one used as an example in this procedure, the selected timer will count elapsed time in millseconds, starting from the value to which it was initially set. The timer will continue to count upward toward 65,535 milliseconds, even if the instruction is removed from the program flow. Neither timer can be made to count downward; however, if allowed to continue timing after reaching its maximum capacity value (65,535), the timer will begin timing from zero again.



(F-44)

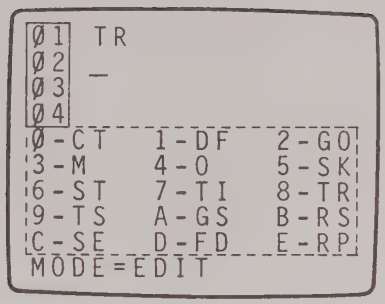
When the TI instruction is executed, the current timer value is compared with the test count (parameter field 3). If the timer value is less than the test count, no branching occurs, and the program proceeds to the instruction in the next program step. However, if the timer value is greater than or equal to the test count, then the program flow is transferred to the program step specified in parameter field 1. In the example given above, a transfer to program step 1Ø will occur when the timer value is greater than or equal to 100. This branching will occur each timer this TI instruction is executed, as long as the timer value equals or exceeds the test count. Note that timer Ø is "reset" when it is executed. Timers 1 and 2 are "tested" when executed and cause a branch only if the "test" determines that maturity value was reached or exceeded.

INSTRUCTION: **Test Receive**
MNEMONIC: **TR**
KEY: **8**

BASIC FUNCTION: The TR instruction establishes the receive data line as the source of characters upon which the user program will operate. The TR instruction passes the current receive-data character to the next instruction and does not pass send-data characters.

FAMILIARIZATION PROCEDURE:

(a) Depress the 8 key once. The TR instruction mnemonic appears, and the cursor moves down to the start of the next instruction line (F-45).



(F-45)

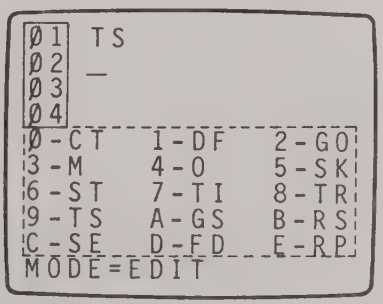
(b) See prompt on screen. Since the TR instruction has no parameters, only one key depression was required to enter it. If desired, the next instruction may now be entered.

INSTRUCTION: **Test Send**
MNEMONIC: **TS**
KEY: **9**

BASIC FUNCTION: The TS instruction establishes the send data line as the source of characters upon which the user program will operate. The TS instruction passes the current send-data character to the next instruction and does not pass receive-data characters.

FAMILIARIZATION PROCEDURE:

(a) Depress the 9 key once. The TS instruction mnemonic appears, and the cursor moves down to the start of the next instruction line (F-46).



(F-46)

(b) See prompt on screen. Since the TS instruction has no parameters, only one key depression was required to enter it. If desired, the next instruction may now be entered.

INSTRUCTION: **GoSUB**
MNEMONIC: **GS**
KEY: **A**

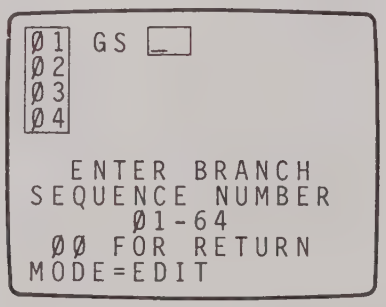
BASIC FUNCTIONS: The GS instruction is used both for branching to subroutines and for returning from subroutines. If the value in the BRANCH SEQUENCE NUMBER field of the GS instruction is within the range 01 through 64, the value is interpreted as being a program step number, and the GS instruction causes an immediate, uncon-

ditional transfer of program control (i.e., unconditional jump) to the specified program step number. This is the "branch-to-subroutine" type of GS instruction. However, if the value in the BRANCH SEQUENCE NUMBER of a GS instruction is ØØ, the instruction carries out the "return-to-subroutine" function, causing an immediate unconditional transfer of program control to the first step number immediately following the most recently executed branch-to-subroutine GS instruction. Each time a GS branch-to-subroutine instruction is executed, the value of the step number to be returned to is stored in the GoSUB stack (part of memory). When a GS return-fromsubroutine (GS ØØ) instruction is executed, the step number most recently stored in the GoSUB stack is essentially removed from the stack and used by the program to determine the next step to be executed. If a GS ØØ instruction is encountered but no GS branch-to-subroutine was previously executed for the return, a STACK UNDERFLOW error is indicated. Nesting (i.e., imbedding of subroutines within subroutines) may be included in the program to a maximum of 16 nesting levels. If more than 16 GS branching instructions are encountered without a GS ØØ instruction being executed, a STACK OVERFLOW error is indicated. The GS instruction passes the character it received from the previous instruction to the next instruction.

FAMILIARIZATION PROCEDURE:

- To enter a branch-to-subroutine GS instruction:

  (a) Depress the A key. The GS instruction mnemonic appears, followed by two negative-video blocks with the cursor in the first block (F-47). For the branch-to-subroutine type of GS instruction, any two-digit number in the range of Ø1 through 64 can be entered in these blocks. This is the BRANCH SEQUENCE NUMBER (or, "branch-to") field and is the only parameter field (i.e., field 1) in the GS instruction. See prompt on screen. Although any of the program steps may be specified as a "branch-to" number, specifying Ø1 or Ø2 in the example just entered in this familiarization procedure would not normally serve a useful purpose (see GOto instruction familiarization procedure for similar case and explanation.



(F-47)

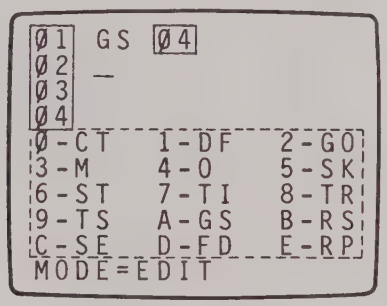
  (b) Depress (in order) the Ø key and the 4 key. The number Ø4 appears in parameter field 1 (in negative video), and the cursor automatically moves down to the start of the next instruction line (F-48). By the above actions, program step Ø4 has been specified as the step that the program will unconditionally jump to when the GS instruction is executed. Instruction contained in intervening program steps are not executed when the jump occurs. Many GS branch-to-subroutine instructions may be used in a program. As long as the number of executed GoSUB instructions does not exceed 16 more than the number of executed GS ØØ Returns, no "stack overflow" error will occur. In an actual program, the program step

specified in the "branch to" field of each GS instruction (step 04 in the example) would contain the first instruction of the subroutine to be executed each time the jump is made for that particular GS instruction. The following should be noted:

(1) The subroutine may consist of one or more instructions (up to the limit of usable remaining program steps).

(2) To return from a subroutine, the last program step in the subroutine must contain a GS 00 instruction. The GS 00 instruction is discussed in the "To enter a return-from-subroutine GS instruction" part of this familiarization procedure, below.

(3) Since program step 64 always contains a Stop (ST) instruction (and therefore does not allow a return to be carried out) the number 64 would not normally be used as the "branch-to" program step in a GS instruction. See GOto instruction familiarization procedure for more information.

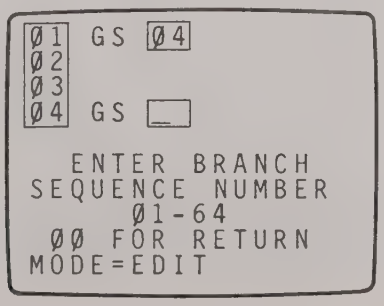


(F-48)

o To enter a return-from-subroutine GS instruction:

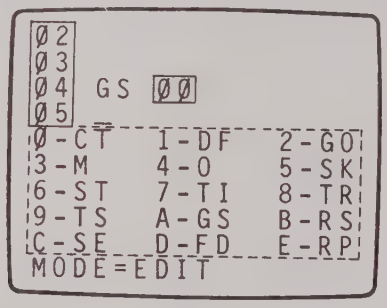
(a) With the GS 04 instruction still on the screen from the first part of this familiarization procedure (F-48), depress the Down Arrow key twice to move the cursor down to program step 04.

(b) Depress the A key. The GS instruction mnemonic appears, followed by two negative video blocks with the cursor in the first block (F-49). See prompt on screen. For return-from-subroutine type of GS instruction, the two-digit expression 00 must be entered in these blocks. This is the BRANCH SEQUENCE NUMBER field (parameter field 1).



(F-49)

(c) Depress the Ø key twice. The expression ØØ appears in parameter field 1 (in negative video), and the cursor automatically moves down to the start of the next instruction line (F-50). By the above actions, the GS return-from-subroutine instruction has been entered. When a GS ØØ instruction is executed, program control is transferred to the program step immediately following the most recently executed GS branch-to- subroutine instruction. In the example used in this procedure, control would be transferred to step Ø2. (Depress Page Up key once or depress Cursor Up key four times to observe steps Ø1 through Ø4 displayed together if desired.) Since no instructions exist in steps Ø2 and Ø3, an attempt to run this particular program would result in a STACK UNDERFLOW error indication. This would occur after the first return from step Ø4, with no GS branch-to-subroutine instruction having been executed before the GS ØØ instruction.



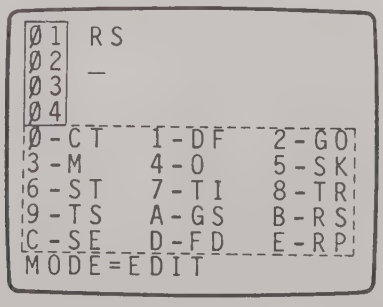
(F-50)

INSTRUCTION: **Reset Stack**
MNEMONIC: **RS**
KEY: **B**

BASIC FUNCTION: The RS instruction resets the GoSUB stack (i.e., stack of return program step numbers for GS instructions). The RS instruction must be executed after a jump caused by a Timer Ø instruction if subsequent program flow will encounter a GS instruction or Return (GS ØØ). The RS instruction passes the character it received from the previous instruction to the next instruction.

FAMILIARIZATION PROCEDURE:

(a) Depress the B key once. The RS instruction mnemonic appears, and the cursor moves down to the start of the next instruction line (F-51).



(F-51)

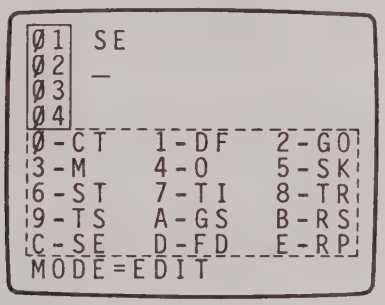
(b) See prompt on screen. Since the RS instruction has no parameters, only one key depression was required to enter it. If desired, the next instruction may now be entered.

```
INSTRUCTION:  Set Event
MNEMONIC:  SE
KEY:  C
```

BASIC FUNCTION: The SE instruction is used to mark the send data (if Test Send is in effect) or receive data (if Test Receive is in effect) character currently being examined by the used program. The character is marked by negative video on the display. The SE instruction passes the character it received from the previous instruction to the next instruction.

FAMILIARIZATION PROCEDURE:

(a) Depress the C key once. The SE instruction mnemonic appears, and the cursor moves down to the start of the next instruction line.



(F-52)

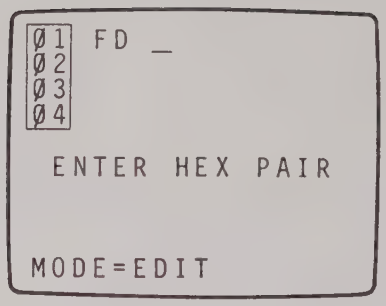
(b) See prompt on screen. Since the SE instruction has no parameters, only one key depression was required to enter it. If desired, the next instruction may now be entered.

```
INSTRUCTION:  Find
MNEMONIC:  FD
KEY:  D
```

BASIC FUNCTION: The FD instruction passes a specified character, and program control, to the next program instruction upon encountering (i.e., "finding") the character in the data stream being searched for by the FD instruction execution. All other characters are discarded by the FD instruction, and program execution will not advance to the next step until the specified character is found. The character to be found is entered as a hex pair in the FD instruction. The FD instruction passes only the "found" character to the next instruction.

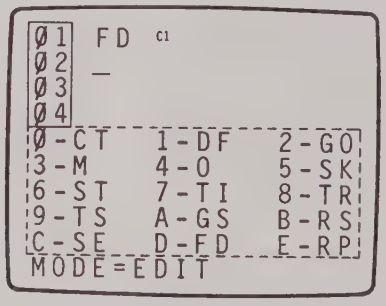
FAMILIARIZATION PROCEDURE:

(a) Depress the D key once. The FD instruction mnemonic appears, and the cursor is automatically positioned two spaces to the right of the mnemonic, at parameter field 1 (F-53). This is the field in which the character to found must be specified. As indicated by the prompt, the character must be entered as a hex pair.



(F-53)

(b) Depress (in order) the C key and the 1 key. The hex number C1 appears in parameter field 1, and the cursor automatically moves down to the start of the next instruction line (F-54). By the above actions, the character to be found by the FD instruction has been specified as the letter "A" if the D-101 is configured (by code selection in Configuration Edit mode) for ASCII or EBCDIC code. (See code conversion charts in Appendix H.) The FD instruction has only one parameter field. If desired, the next instruction may now be entered.



(F-54)

INSTRUCTION:	**Repeat**
MNEMONIC:	**RP**
KEY:	**E**

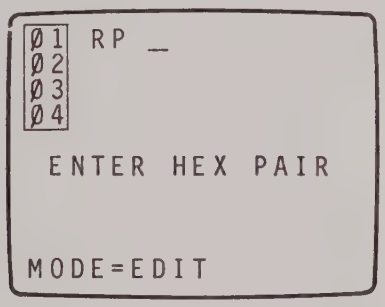
BASIC FUNCTION: The RP instruction discards a specified character upon each occurrence of the character in the data stream during RP instruction execution. For any other character encountered, the RP instruction passes program control, and the character, to the next program instruction. The RP instruction will continue to discard the specified character even if it occurs in a repetitive string, and program execution will not advance to the next step as long as the character is repeated. The character to be discarded is entered as a hex pair in the RP instruction. The RP instruction passes to the next instruction the first character it receives that is not the specified character.

Note: The RP instruction is often used in conjunction with the FD instruction to sync the portion of the program that follows the RP instruction. For this function, the RP instruction is located immediately after the FD instruction in the program, and the sync character is specified in both instructions. The FD instruction passes only the sync character to the RP instruction, and the RP instruction discards the sync character passed to it from the FD instruction. The RP instruction will not pass program control to the next instruction until the string of sync

characters is broken by the occurrence of a different character. Thus, the start of execution of the subsequent program steps is synchronized to the occurrence of the first non-sync character.

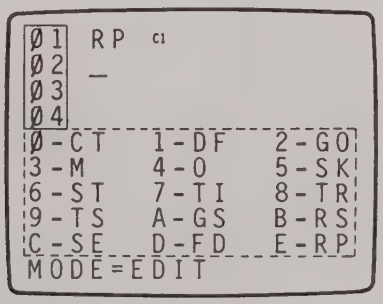
FAMILIARIZATION PROCEDURE:

(a) Depress the E key once. The RP instruction mnemonic appears, and the cursor is automatically positioned two spaces to the right of the mnemonic, at parameter field 1 (F-55). This is the field in which the character to be discarded must be specified. As indicated by the prompt, the character must be entered as a hex pair.



(F-55)

(b) Depress (in order) the C key and the 1 key. the hex number C1 appears in parameter field 1, and the cursor automatically moves down to the start of the next instruction line (F-56). By the above actions, the character to be discarded by the RP instruction has been specified as the letter "A" if the D-101 is configured (by CODE selection in Configuration Edit mode) for ASCII or EBCDIC code. (See code conversion charts in Appendix H.) The RP instruction has only one parameter field. If desired, the next instruction may now be entered.



(F-56)

APPENDIX G.
TECHNICAL SPECIFICATIONS

D-101 technical specifications are given in Table G-1.

TABLE G-1. TECHNICAL SPECIFICATIONS

CATEGORY	SPECIFICATIONS
MECHANICAL DATA	• Case Construction: ABS plastic (fire retardant) • Color of Case: Blue • DIMENSIONS: 5 in. high x 14-1/2 in. wide x 13-3/4 in. deep (12.7 cm x 26.8 cm x 24.9 cm) • Weight: 14.5 lbs (6.6 kg)
ENVIRONMENTAL DATA	• Ambient Temperature Range: Operating, +50 to 122°F (+10 to + 50°C); Storage, -40 to +149°F (-40 to +65°C) • Humidity: 10 to 80 percent, noncondensing • Altitude: 10,000 ft (3048 m)
DATA COMMUNICATION CHARACTERISTICS	• Transmission Rates: 31 to 19,200 bps with clock error less than ±0.5 percent of bit rate • Transmission Modes: Asynchronous, Synchronous, and SDLC Direct or NRZI • Number of Start/Stop Bits (asynchronous mode): 1 start bit; 1 or 2 stop bits • Character Length (excluding parity bit): 8, 7, 6, or 5 bits • Parity: Even, odd, or none • Data Justification: Toward least significant bit (within D-101) Error Detection: Block Check Character generation and checking (LRC-8, CRC-16, or CRC-CCITT type), also parity generation and checking
VIDEO DISPLAY	• Display Type: Black and white, raster-scanned; alphanumeric dot matrix characters with two levels of intensity • CRT Type: 3-inch diagonal, with integral implosion protection; P4 (white) phosphor screen

TABLE G-1. TECHNICAL SPECIFICATIONS (CONTINUED)

CATEGORY	SPECIFICATIONS
DATA ENTRY AND OPERATING CONTROLS	• Front panel tactile-feedback membrane switches
POWER REQUIREMENTS	• AC Input Voltage, two voltage ranges - Low and high: • Low range accommodates: 90-138 VAC (and unit is marked 120 VAC on rear panel) • High range accommodates: 184-276 VAC (and unit is marked 240 VAC on rear panel) Power: 140 watts Fusing: 2A/250V normal blow for 120 VAC; 1A/250V normal blow for 240V • Internal Power Supply Outputs: +5, -5, +12, and -12 Vdc

APPENDIX H

HEX-ASCII AND HEX-EBCDIC CONVERSION CHARTS

Top horizontal line represents most significant hex digit
First vertical line represents least significant hex digit
Chart lists 128 ASCII characters
96 = Data
32 = Control

	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0	N_U	D_L	SP	0	@	P	`	p	N_U	D_L	SP	0	@	P	`	p
1	S_H	D_1	!	1	A	Q	a	q	S_H	D_1	!	1	A	Q	a	q
2	S_X	D_2	"	2	B	R	b	r	S_X	D_2	"	2	B	R	b	r
3	E_X	D_3	#	3	C	S	c	s	E_X	D_3	#	3	C	S	c	s
4	E_T	D_4	$	4	D	T	d	t	E_T	D_4	$	4	D	T	d	t
5	E_Q	N_K	%	5	E	U	e	u	E_Q	N_K	%	5	E	U	e	u
6	A_K	S_Y	&	6	F	V	f	v	A_K	S_Y	&	6	F	V	f	v
7	B_L	E_B	'	7	G	W	g	w	B_L	E_B	'	7	G	W	g	w
8	B_S	C_N	(	8	H	X	h	x	B_S	C_N	(	8	H	X	h	x
9	H_T	E_M	)	9	I	Y	i	y	H_T	E_M	)	9	I	Y	i	y
A	L_F	S_B	*	:	J	Z	j	z	L_F	S_B	*	:	J	Z	j	z
B	V_T	E_C	+	;	K	[	k	{	V_T	E_C	+	;	K	[	k	{
C	F_F	F_S	,	<	L	\	l	¦	F_F	F_S	,	<	L	\	l	¦
D	C_R	G_S	-	=	M	]	m	}	C_R	G_S	-	=	M	]	m	}
E	S_O	R_S	.	>	N	↑	n	⌐	S_O	R_S	.	>	N	↑	n	⌐
F	S_I	U_S	/	?	O	←	o	D_T	S_I	U_S	/	?	O	←	o	D_T

Hex-ASCII Conversion

Top horizontal line represents most significant hex digit
First vertical line represents least significant hex digit
Chart lists 137 EBCDIC characters
111 = Data
26 = Control

	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0	N_u	D_L	D_S		SP	&	-									0
1	S_H	D_1	S_S				/		a	j			A	J		1
2	S_X	D_2	F_S	S_Y					b	k	s		B	K	S	2
3	E_X	D_3							c	l	t		C	L	T	3
4	P_F	R_E	B_P	P_N					d	m	u		D	M	U	4
5	H_T	N_L	L_F	R_S					e	n	v		E	N	V	5
6	L_C	B_S	E_B	U_C					f	o	w		F	O	W	6
7	D_T	I_L	E_C	E_T					g	p	x		G	P	X	7
8		C_N							h	q	y		H	Q	Y	8
9		E_M							i	r	z		I	R	Z	9
A	M_M	C_C	S_M		¢	!		:								
B	V_T				.	$	,	#								
C	F_F	I_F		D_4	<	*	%	@								
D	C_R	I_G	E_Q	N_K	(	)	_	'								
E	S_O	I_R	A_K		+	;	>	=								
F	S_I	U_S	B_L	S_B	|	¬	?	"								

Hex-EBCDIC Conversion

APPENDIX I

ERROR MESSAGES

Upon detection of an error condition, the D-101 displays an error message that indicates the specific type of error encountered. In general, these error indications may occur for the following:

(a) Attempting to load the D-101 from a source (e.g., option PROM or option module) that is not presently connected to the D-101.

(b) Attempting to run a user program with no user program present in the D-101.

(c) Attempting to run a user program that has certain error-causing defects.

(d) Attempting to compile a Level I program that contains programming errors that are detectable by the D-101 compiler. This type of error is termed a "compiler error".

(e) Attempting to execute a return instruction that was not preceeded by an associated GOSUB instruction.

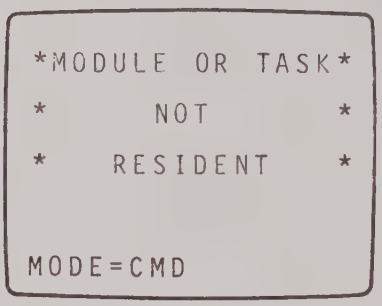
(f) Attempting to execute a GOSUB instruction whose level of nesting exceeds sixteen.

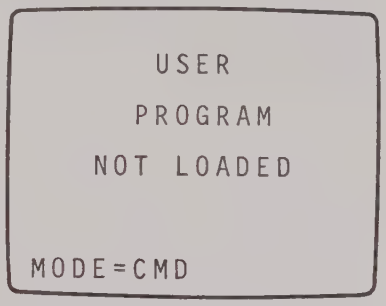
(g) Failure of an autoconfiguration attempt.

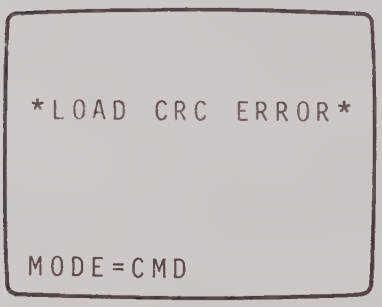
The specific error messages and the conditions that will cause them to be displayed are described in the following pages.

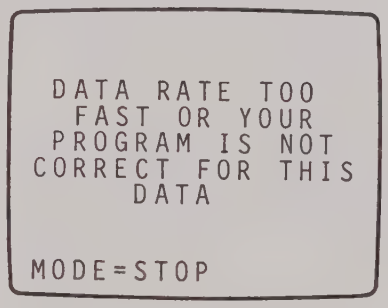
COMMAND MODE/RUN MODE ERRORS

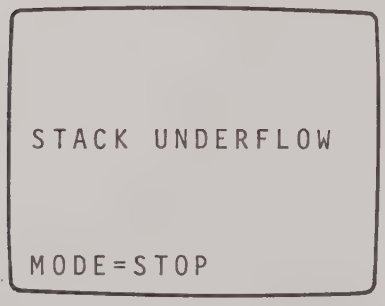
Error messages encountered in Command mode or Run modes are shown in the following screen illustrations and described further in Table I-1.

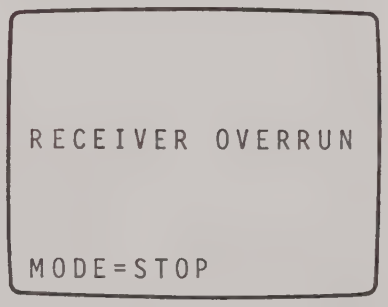


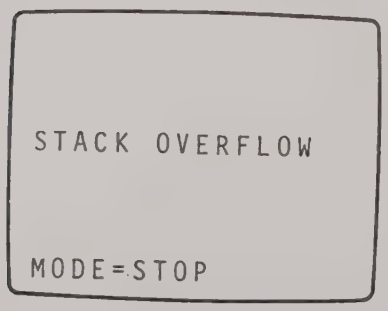












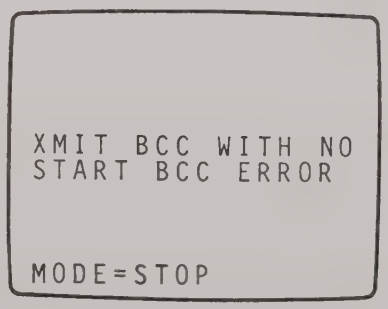


TABLE I-1 COMMAND MODE/RUN MODE ERRORS

ERROR MESSAGE	MEANING
MODULE OR TASK NOT RESIDENT	Edit/Compile PROM not plugged in to PROM socket (which is located in PROM module drawer). Displayed upon selection of LEVEL I EDITOR in Command mode menu. Option PROM not plugged in to PROM socket (which is located in PROM module drawer). Displayed upon selection of OPTION PROM in Command mode menu. Option module not plugged in to PROM socket (which is located in PROM module drawer). Displayed upon selection of OPTION MODULE in Command mode menu.
LOAD CRC ERROR	Level III user program PROM not plugged in to PROM socket (in PROM module drawer) or damaged. Displayed after selection of PROGRAM LOAD in Command mode menu, upon depression of Ø key to select PROM program source.
STACK UNDERFLOW	A "running" user program attempted to execute a return (GOSUB ØØ) instruction that was not preceeded by an associated GOSUB instruction.
USER PROGRAM NOT LOADED	An attempt has been made to run a program with no user program loaded in the D-101. Displayed upon depression of the RUN PRGM key.
DATA RATE TOO FAST OR YOUR PROGRAM IS NOT CORRECT FOR THIS DATA	Either: (1) user program erroneous; fails to "fetch" characters as is done by the Match, Skip, Find and Repeat instruction, or (2) complexity of the user program, combined with a high on-line data rate, requires more than the available processor bandwidth. Error stops program.
RECEIVER OVERRUN	The user program (or monitoring) required too much time to process characters arriving from the communication line, As a result, the D-101 has attempted to overwrite previously received characters in the D-101 receiver with newly arriving characters before the previous characters could be fetched from the receiver for processing. Error stops program.
XMIT BCC WITH NO START BCC ERROR	An END BCC has been encountered in an Output instruction with no START BCC previously encountered in the user program. Error stops program. It is not necessary to specify START BCC in the same Output instruction wherein END BCC has been specified; the START BCC may be included in a previous Output instruction (but must appear before END BCC is encountered in the program).
STACK OVERFLOW	A "running" user program attempted to execute a GOSUB instruction whose level of nesting exceeds sixteen.

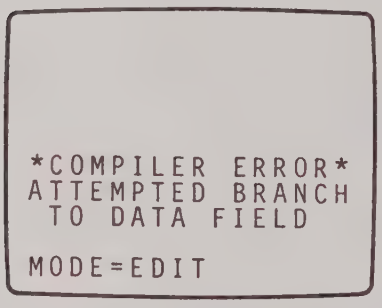
COMPILER ERRORS

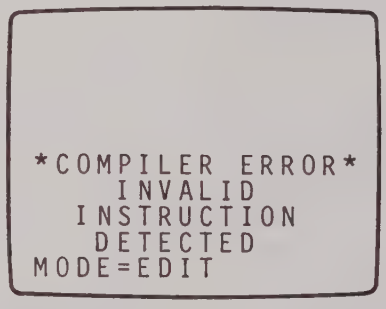
When the COMMAND key is depressed with the D-101 in Edit mode, the Operating System compiler attempts to compile the Level I user program that was keyed-in or edited in Edit mode. If the program contains no errors that are detectable by the compiler, then the message

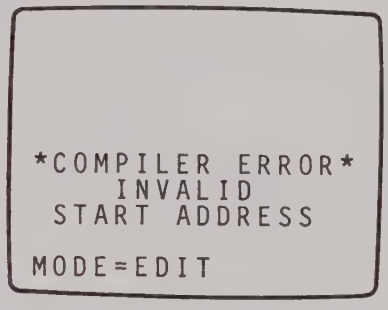
PROGRAM COMPILED

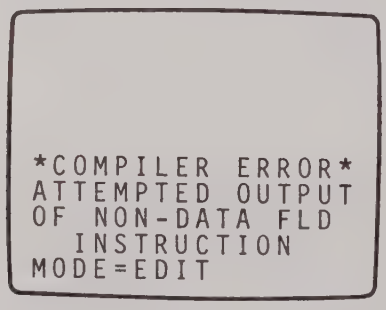
appears on the screen, indicating that the compile was successful, the program is ready to be run, and the Command mode is invoked.

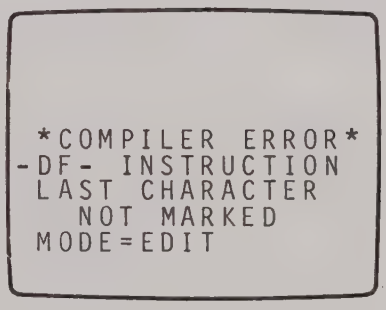
However, errors in the program can result in an unsuccessful attempt to compile when the COMMAND key is depressed in Edit mode. If this occurs the compiler returns the D-101 to the Edit mode, and a compiler error message is displayed. The compiler error messages and their meanings are given in Table I-2. The condition that caused the compiler error to occur must be removed by changing the program; after the program is corrected it may be compiled by depressing the COMMAND key again.

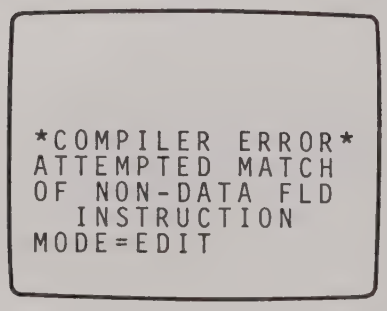












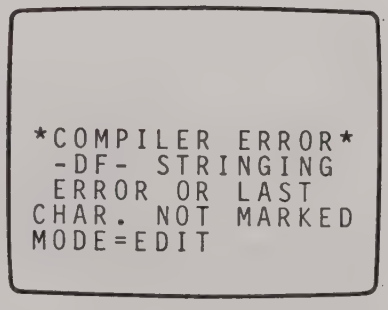
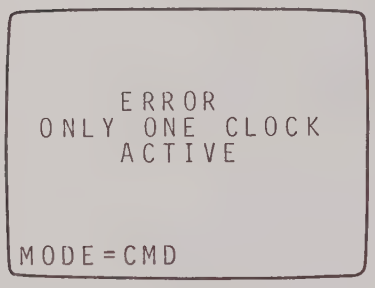


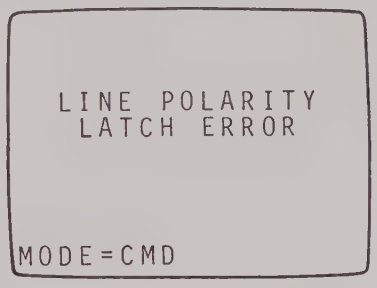
TABLE I-2. COMPILER ERROR MESSAGES

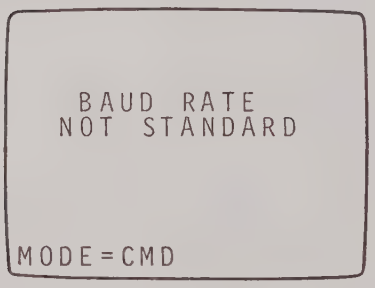
ERROR MESSAGE	MEANING
ATTEMPTED BRANCH TO DATA FIELD	A branch (e.g.,, by GO instruction) to a data field (DF) is being attempted.
ATTEMPTED OUTPUT OF NON-DATA FLD INSTRUCTION	A non-data field instruction is being used as a data source for an Output (O) instruction. (Data source must be a DF.)
ATTEMPTED MATCH OF NON-DATA FLD INSTRUCTION	A non-data field (non-DF) instruction is being used as a data source for a Match (M) instruction. (Data source must be a DF.)
INVALID INSTRUCTION DETECTED	This error is not the result of a user program error. Appearance of the message indicates that the compiler has encountered (i.e., read) defective locations in program memory (in RAM) while attempting the compile. If this occurs, it is advisable to run the D-101 self-test (see Appendix A).
-DF- INSTRUCTION LAST CHARACTER NOT MARKED	The last character of a data field (DF) in the program was not marked (must be marked by depressing ENTER key with cursor on character).
-DF- STRINGING ERROR OR LAST CHAR. NOT MARKED	An unmarked data field (DF) with less than 10 characters is being used as a line before the last line within a two-line or multi-line string. (Any unmarked line within a DF must have 10 characters.)
INVALID START ADDRESS	Program execution was started on a data field (DF). (Program execution may not be started on a DF, but may be started on any other type of instruction.) Program execution always starts from position where cursor was left in Edit mode.

Autoconfiguration Errors

Error messages encountered during an autoconfiguration attempt are shown in the following illustrations and described in Table I-3.







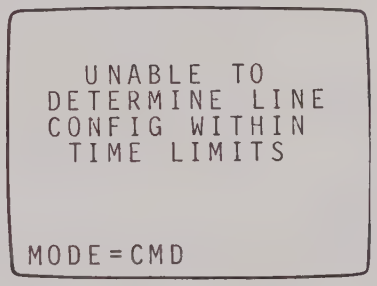


TABLE I-3. AUTOCONFIGURATION ERRORS

ERROR MESSAGE	MEANING
ERROR ONLY ONE CLOCK ACTIVE	Only send or receive clock is active. Other clock of the pair is inactive.
UNABLE TO DETERMINE LINE CONFIG WITHIN TIME LIMITS	Time limit on autoconfiguration attempt inadequate or protocol not within autoconfiguration capability
LINE POLARITY LATCH ERROR	Unable to determine line polarity
BAUD RATE NOT STANDARD	Baud rate is not within autoconfiguration capability (Page B-1, item 5 lists autoconfiguration baud rates)

APPENDIX J

D-101 PIN DESIGNATIONS

Table J-1 shows the status of each pin of the RS-232 interface with the D-101 connected in any of the three basic setups:

Monitor
Simulate Terminal
Simulate Modem

Refer to Section 3 for connection details

TABLE J-1. D-101 INTERFACE CONFIGURATIONS WITH PIN DESIGNATIONS

PIN NO.	EIA DESIGNATION		DATASCOPE DESIGNATION		DATASCOPE CONNECTORS ①				STATUS OF PIN FOR INTERFACE CONFIGURATIONS ②		
	LEAD	DESCRIPTION	NAME	MNEMONIC	TEST	BUS. MACH.	MODEM	AUX.	MONITOR	TERMINAL SIM. (TO MODEM)	MODEM SIM. (TO TERM.)
1	AA	Protective Ground	Frame (or Chassis) Ground	FG	A	A	A	A	Frame Ground	Frame Ground	Frame Ground
2*	BA	Transmitted Data	Send Data	SD	A	A	A	A	Bridged. SD input from DTE ③	Driven by D-101, enabled by CTS. SD output to DCE ④	Terminated. SD input from DTE ⑤
3*	BB	Received Data	Received Data	RD	A	A	A	A	Bridged. RD input from DCE ③	Terminated. RD input from DCE ④	Driven by D-101. RTS output to DTE ⑤
4*	CA	Request to Send	Request to Send	RTS	A	A	A	A	Bridged. RTS input from DTE. D-101 can be configured to use RTS as a marker	Driven by D-101. RTS output to DCE	Terminated. RTS input from DTE
5*	CB	Clear to Send	Clear to Send	CTS	A	A	A	A	Bridged. CTS input from DCE. D-101 can be configured to use CTS as a marker	Terminated. CTS input from DCE (Must be active for SD output)	Driven by D-101; has programmable delay. CTS output
6*	CC	Data Set Ready	Data Set Ready	DSR	A	A	A	Open	Bridged. DSR input from DCE.	Terminated. DSR input from DCE.	Driven continuously by D-101 upon entry into Modem Sim. mode; HIGH=ON
7	AB	Signal Ground (Common Return)	Signal Ground	SG	A	A	A	A	Signal Ground	Signal Ground	Signal Ground
8*	CF	Received Line	Carrier Detect	CD	A	A	A	A	Bridged. CD input from DCE. D-101 can be configured to use CD as a marker.	Terminated. CD input from DCE	Driven (switched or always active) by D-101. CD output
9	-	(Reserved for Data Set Testing)	+12 Vdc (Power to RCU)	-	S	S	Open	Open	-	-	-
10	-	(Reserved for Data Set Testing)	-12 Vdc (Power to RCU)	-	S	S	Open	Open	-	-	-

TABLE J-1. D-101 INTERFACE CONFIGURATIONS WITH PIN DESIGNATIONS (CONT)

PIN NO.	EIA DESIGNATION		DATASCOPE DESIGNATION		DATASCOPE CONNECTORS ①				STATUS OF PIN FOR INTERFACE CONFIGURATIONS ②		
	LEAD	DESCRIPTION	NAME	MNEMONIC	TEST	BUS. MACH.	MODEM	AUX.	MONITOR	TERMINAL SIM. (TO MODEM)	MODEM SIM. (TO TERM.)
11*	-	(Unassigned)	TP IN (Read Test Point)	-	AT	AT	AT	Open	Bridged. Calibrated (+3.2V) EIA level detector for TP portion of LEAD STATE display	Bridged. Calibrated (+3.2V) EIA level detector for TP portion of LEAD STATE display	Bridged. Calibrated (+3.2V) EIA level detector for TP portion of LEAD STATE display
12	SCF	Sec. Received Line Signal Detector	Secondary Carrier Detect	SCD	A	A	A	Open	-	-	-
13	SCB	Secondary Clear to Send	Secondary Clear to Send	SCTS	A	A	A	Open	-	-	-
14	SBA	Secondary Transmitted Data	Secondary Transmitted Data	SSD	A	A	A	Open	-	-	-
15*	DB	Transmission Signal Element Timing (DCE Source)	Transmit Clock	SCT	A	A	A	Open	Bridged. Internally or externally generated; used to clock send data ⑥	Terminated. Externally generated; used to clock send data	-
16	SBB	Secondary Received Data	Secondary Received Data	SRD	A	A	A	Open	-	-	-
17*	DD	Receiver Signal Element Timing (DCE Source)	Receiver Clock	SCR	A	A	A	Open	Bridged. Externally generated; used to clock receive data in ⑥	Terminated. Externally generated; used to clock receive data in ⑥	-
18	-	(Unassigned)	TP OUT (Write Test Point)	-	AT	AT	AT	Open	Pin always EIA low (approx. -12V) unless driven nigh (approx. +12V) under control of ROM-module program	Pin always EIA low (approx. -12V) unless driven high (approx. +12V) under control of ROM-module program	Pin always EIA low (approx. -12V) unless driven high (approx. +12V) under control of ROM-module program
19	SCA	Secondary Request to Send	Secondary Request to Send	SRTS	A	A	A	Open	-	-	-
20*	CD	Data Terminal Ready	Data Terminal Ready	DTR	A	A	A	A	Bridged. DTR input from DTE	Driven continuously by D-101 upon entry into Term. Sim. mode	Terminated. DTR input from DTE

TABLE J-1. D-101 INTERFACE CONFIGURATIONS WITH PIN DESIGNATIONS (CONT)

PIN NO.	EIA DESIGNATION		DATASCOPE DESIGNATION		DATASCOPE CONNECTORS ①				STATUS OF PIN FOR INTERFACE CONFIGURATIONS ②		
	LEAD	DESCRIPTION	NAME	MNEMONIC	TEST	BUS. MACH.	MODEM	AUX.	MONITOR	TERMINAL SIM. (TO MODEM)	MODEM SIM. (TO TERM.)
21*	CG	Signal Quality Detector	Signal Quality Detector	SQ	A	A	A	Open	Bridged. SQ input from DCE. D-101 can be configured to use SQ as a marker	Terminated. SQ input from DCE	Driven continuously by D-101 upon entry into Modem Sim. mode
22*	CE	Ring Indicator	Ring Indicator	RI	A	A	A	A	Bridged. RI input from DCE	Terminated. RI input from DCE	Bridged. Pin 22 jumpered to pin 18 for RI function
23	CH/CI	Data Signal Rate Selector (DTE/DCE Source)	Data Signal Rate Selector	DSRS	A	A	A	Open	-	-	-
24	DA	Transmit Signal Element Timing (DTE Source)	Sync Clock Transmit Circuit	SCTE	A	A	A	Open	Bridged. SCTE input from DTE ⑥	Driven by D-101 (internally generated) ⑥	Terminated. SCTE input from DTE. ⑥
25	-	(Unassigned)	Interface Unit Clock	IU CLK	AI	AI	AI	Open	Bridged ⑥	Bridged ⑥	Bridged ⑥

*Displayable by selecting Lead State Display.

NOTES:

① Meanings of symbols used in DATASCOPE CONNECTORS column:

A = pin is active,
S = pin is source of power for optional RCU. (Essentially, RCU is a line driver with high-impedance inputs, for connection of D-101 into system from a distance.)
AT = pin is active for testing.
AI = pin carries Interface Unit Clock (supplied by RCU).

② Meanings of terms in STATUS OF PIN FOR INTERFACE CONFIGURATIONS column:
"TERMINAL SIM." = D-101 simulates DTE.
"MODEM SIM." = D-101 simulates DCE.
"Bridged" = connected to a high impedance (30 kilohms min.).
"Terminated" = connected to a proper EIA terminating impedance (about 4 kilohms).
"Driven" = output supplied via an EIA driver (±12 volts).

③ Internal Clocks: SD clocked-in by internal send clock; RD clocked-in by internal receive clock. External Clocks: With Modem source, SD clocked-in by SCT (pin 15) and RD clocked-in by SCR (pin 17); with SCTE source, both SD and RD clocked-in by SCTE (pin 24); with IU source, both SD and RD clocked-in by IU CLK (pin 25).

④ Internal Clocks: SD clocked-out by internal send clock; RD clocked-in by internal receive clock. External Clocks: With Modem source, SD clocked-out by SCT (pin 15) and RD clocked-in by SCR (pin 17); with IU source, SD clocked-out and RD clocked-in by IU CLK (pin 25).

⑤ Internal Clocks: SD clocked-in by internal send clock; RD clocked-out by internal receive clock. External Clocks: With SCTE source, SD clocked-in and RD clocked-out by SCTE (pin 24); with IU source, SD clocked-in and RD clocked-out by IU CLK (pin 25).

⑥ May be used as data clock source. See NOTES 3, 4, 5 for applicability. Internal clock may be used as an alternative to these external clocks. Selection of the clock source is made in Configuration Edit mode as indicated by the displayed prompts. The possible alternative choices are A = Modem (SCT and SCR on pins 15 and 17, respectively), B = External (SCTE on pin 24), C = IU (IU Clock on pin 25), or Internal (selectable from 31 to 19,200 bps).

APPENDIX K

PRINTER INTERFACE

This appendix provides the information required to: (1) connect the printer port (AUX connector) of a D-101 to a suitable serial-data printer, either via cable or data line, and (2) select the "best" set of configuration alternatives available with a given combination of printer and data channel. The following are factors to be considered:

(1) The D-101 can be cabled directly to a local printer, or can be connected via asynchronous modems to a distant printer.

(2) It is generally advantageous to transfer data to a printer at the highest baud rate it can accept.

(3) Any baud rate acceptable to both D-101 (31-19200 bps) and printer (refer to its technical manual) can be employed if the units are cabled directly together; data channel speed (and modem speed) are normally the factors that determine baud rate when the data is transferred via modems.

(4) It is generally most convenient to employ the D-101 (printout facility) default configuration if the data channel and printer can operate at that speed (1200 bps), and if the printer can be configured to these (default) parameters:

Baud rate	1200 bps
Line Termination mode	CR/LF (printer responds individually to line feed [ØA] and carriage return [ØD])
Form feed mode	ON (printer responds to form feed [ØC])
Parity mode	NONE (no parity bit)
Data bits (per character)	8

(5) If the printer (or data channel, if used) can not accommodate the D-101 printout default parameters, the below-listed alternatives can be keyed into the D-101; however, the "alternative" configuration must be entered again each time the D-101 is RESET or turned off then on again. Entry to the printout configuration editor is via key Ø when the PRT CMD menu appears on the CRT. The configuration alternatives are:

Baud rate	31-19200 bps
Line termination mode	CR (printer performs a carriage return and a line feed when it receives a CR [ØD] character)
Form feed mode	OFF (printer can not perform a top-of-form operation. D-101 provides multiple CRs or LF/CRs to attain top-of-form).
Parity	ODD or EVEN (D-101 appends appropriate parity bit to each data byte)
Data bits	7 (printer accepts 7-bit data bytes)

(6) The printout facility configuration display allows for selection of AUTO PAGE, ON or OFF. If ON, each new printout begins at top-of-form; if OFF, printout continues immediately below the last printout.

(7) The printer should be initialized at top-of-form before the D-101 printout facility is invoked.

CONNECTION

Connect the D-101 printer port (AUX connector) to the printer RS-232 port (data input) in either of two ways:

(1) For distances served by a 50-foot (maximum length) cable - use a modem-eliminator-type cable, Spectron Marketing P/N 75-183.

(2) For any distance - use asynchronous modems and ordinary data cables connected as a standard data channel.

CONFIGURATION

Proceed as follows:

1. Considering the seven above-mentioned factors, set the printer configuration appropriately.

2. When ready to employ the D-101 printout facility, install the "PRINT" PROM and press the 5 key. If you are using the D-101 (printout) default parameters, no further action is required. Proceed with printout operation. If the D-101 printout parameters require change, press the Ø key and continue with step 3.

3. Observing the PRT CONFIG display, use the cursor control keys (▼and▲) as required to position the cursor under a parameter to be changed.

4. Using the negative-video prompts to guide selection, enter the desired parameter(s).

5. Repeat steps 3 and 4 until all configuration parameters are satisfactory.

6. Press the COMMAND MODE key (to return to the PRT CMD menu display). The D-101 is now ready for printout operation.

APPENDIX L

GLOSSARY

A

ABORT - Interruption and cancellation of a running program without scanning the completed fields. In the D-101 the Abort function also applies to the STOP command used during any Execution operation (Level I Edit mode, Configuration mode, Program Load, etc.) In addition, it provides for orderly premature termination of an SDLC message being transmitted, by supplying the required terminating protocol.

ASCII - American Standard Code for Information Interchange. A coding system with 128 possible characters, 96 of which are used for data and 32 for control. In the D-101, ASCII is treated as a standard character code, one of four options from the user's environment.

ASYNCHRONOUS - Asynchronous systems are those not timed by a master clock. Asynchronous data transmission employs Start and Stop bits sent with each character to coordinate the receiving station with the sending transmission.

AUTOCONFIGURATION - In the D-101 this refers to a feature that permits the unit to acquire one of a number of standard line configurations (see INTERFACE CONFIGURATION) automatically when connected to such a line in the monitoring setup.

B

BCC - Block Check Characters are bit characters added to transmitted messages to verify reliability and accuracy of data transmission. The BCC characters are part of the user's environment and are identified and specified in the Configuration Table. Level I program code O (Output Data String) and Level III code SBCC/TBCC (Start/Stop BCC Accumulation) provide program control for BCC types as follows:

1. Incoming Data Check Characters
   - With software
     LRC-8 (longitudinal redundancy check)
     CRC-16 (cyclic redundancy check - bisync)
   - With hardware
     CRC-CCITT (SDLC/HDLC)

2. Outgoing Simulated Data Check Characters
   - With software
     LRC-8 (longitudncal redundancy check)
   - With hardware
     CRC-16 (cyclic redundancy check)
     CRC-CCITT (SDLC/HDLC)

BIT ORDER (1-8/8-1) - Normal bit order for the D-101 is 8-1, which means the least significant bit positioned as bit 1 arrives first on the line. The nonstandard bit order (Reversed) is 1-8, with the most significant bit positioned as bit 8 arriving first on the line. Either the normal or the nonstandard bit

order option can be implemented in Level III programs by means of the configuration tables inserted via the D-1001 keyboard.

BUFFER - An interface data storage facility used to accommodate data transfer between circuits operation on different schedules or with different timing, etc.

BUGS - Faults and errors discovered in software programs. These are inherent in newly developed programs, which normally require a period of operational testing, checking and debugging.

BURN (PROM) - The term "burn" refers to the operation (electrical or otherwise) by which PROM (Programmable Read Only Memory) chips are modified to assure a selected circuit configuration. In the D-101/D-1001 the meaning of the "burn" term is expanded to describe the process of inscribing a previously generated and tested user program into the components of a customized PROM module. The resultant application program contained in the PROM is conveniently loadable into the D-101 for use in testing RS-232-type communication lines.

C

CLEAR - To reset or clear a storage device such as a register or memory by deleting all data and returning all locatins to zero state. In the D-101 a CLEAR PROGRAM control key on the keypad is used in Edit mode to clear the Edit buffer of any existing program.

CODES (CHARACTER) - Codes for data communication refer to numerical systems made up of characters that represent information and data messages. A number of such codes are presently available. The D-101/D-1001 is adaptable for operation with three standard data codes (HEX, ASCII, EBCDIC) and one user selected "protocol" code (or two protocol codes if EBCDIC is removed from the list). All D-101 application test programs conform to whatever data code is employed in a user's communication line. This accommodation as well as other aspects of the user's environment are designated by the D-101 Configuration Table stored in D-101 memory with each application program. Both standard and optional "protocol" codes are displayed on the D-101 CRT. All codes can be converted to Hexidecimal for display by pressing the HEX key on the keyboard. Also, undefined characters from other codes will default to Hex. All ASCII and EBCDIC code characters are listed in Appendix H with their Hex relationships. For further details see ASCII, EBCDIC, and HEX definitions.

CONFIGURATION (Automatic) - See AUTOCONFIGURATION.

CONFIGURATION (Interface) - See INTERFACE CONFIGURATION.

CONFIGURATION TABLE - A Configuration Table is generated for every user program employed in the D-101 or developed in the D-1001. This Configuration Table specifies and defines the environment of the user communication channel in which the associated application program is designed to operate. In the D-101, the Configuration parameters are inserted in the Table by the autoconfiguration facility, by means of the keyboard and CRT, or by loading a Level III ROM program. See Appendix C, Configuration Table Fields. See also PROMPTS.

CONTROL LEADS - The term Control Leads (sometimes described as Line Interface Control Flags) refers to eight EIA control leads which are part of each standard RS-232 data communication link. The eight control leads provide test, status, and control signals to accompany the communication data. The functions include "handshake" signals between modems and terminals, signal quality, line ringing, and tests. Variations in the use of the control leads for DATASCOPE application programs are specified in the associated Configuration Tables. See Appendix J for control lead pin designations.

COUNTER - Counters are employed for counting events in D-101 and D-1001 software. Two counters are available in each. Counter instructions are inserted via the keyboards. Level I instruction sets provide a CT OPcode with increment, test, and reset operands for No. 1 and No. 2 counters. Level III instruction sets generated in the D-1001 have counter instruction options for set, reset, increment, decrement, test, and compare.

CTS DELAY - The Optional CTS Delay (1 to 255 milliseconds) feature in the D-101 is provided to accommodate circuit requirements for data communication that must wait for an RTS (Request to Send) transition from OFF to ON to be supplied by the Terminal equipment. A selected CTS delay is inserted via Configuration Table for Modem Simulation programs. See CONTROL LEADS entry for further details.

CURSOR - A position indicator on D-101 or D-1001 CRT displays, used to indicate a character to be corrected or a position in which operands are to be inserted. Cursor movement is limited to enterable fields, only, as determined by D-101 or D-1001 software editors.

DATA CODES - See CODES (Character)

DEBUG - The normal process of correcting software errors before compiling. See definition of BUGS.

DEFAULT - An operational sequence or running program instruction with missing operands that initiates a jump by default to a conclusion not related to the original operational pattern.

DISABLE - A missing contributory status or condition that stops operation or running program. Used as in "enable/disable".

DISPLAY ATTRIBUTES - See IMAGE MODIFIERS (Attributes)

DON'T - A selected character designated to seek a "Don't Match" comparision in a Data String Match instruction. DON'T characters are marked as such in D-101 Level I programs by placing the cursor under the character and depressing the DON'T key. The character will be displayed in half-intensity to signify the "Don't Match" state. If the "Don't" comparison is successful, output instructions will ignore the Don't marker and output the charcter as they would any other character in the data string.

DON'T NOT - A "Don't Not" is an inverted version of a "Dont' Match" character. It is designated to seek a Don't (N) comparision in a Data String Match instruction. DON'T NOT characters are marked as such in D-101 Level I programs by

placing the cursor under the character and depressing the DON'T/NOT key. If the Don't Not comparision is successful (no inverted match found) output instructions will ignore the Don't Not marker and output the character as they would any other character in the data string.

DOWNLOAD - Refers to the direct transport via interconnecting cable of an object program from the D-1001 to the D-101. This dynamic program loading of the D-101 enables checkout of an application program in the D-101 and debugging from "on-line" condition.

EBCDIC - Extended Binary Coded Decimal Interchange Code. A coding system with 256 possible characters. In the D-101 EBCDIC is treated as a standard character code acceptable as a coding option for D-101 user's data inputs. Selection of EBCDIC for monitoring, CRT displays, or simulated output data is controlled by Configuration Tables that specify environments for individual programs. See Appendix H, which lists relationship of EBCDIC characters to HEX-coded characters.

EDIT BUFFER - A generalized term for identifying the location of source programs during Edit mode. See SOURCE BUFFER.

EDITOR - A software utility designed to assist in the editing and checkout of user programs and configuration talbes plus various D-101/D-1001 internal programs. The editor software facilitates insertion of program instructions and commands by means of prompts on CRT displays; also by cursor control and definition of enterable fields. Instructions are checked for validity and completeness by the editor. Operands inserted are flagged if they exceed acceptable limits. See PROMPTS and ENTERABLE FIELDS for further details.

ENABLE - A contributory status or condition that facilitates turn on or running of a program or operation; used as in "enable/disable".

ENTERABLE FIELD - Refers to a display field approved for insertion of valid inputs by the software editors into edit buffer, configuration tables, etc. Insertion of instructions, commands and configuration data is accomplished by use of the CRT and keyboard. The editor software will not allow the cursor to be moved from an enterable field with insertion of instructions or parameters started but left in error or incomplete. Invalid entries are flagged. See CURSOR and FIELD for other details.

EVENT - The occurrence of any character or string of characters previously designated for recognition as "an event".

F

FDX (Full-Duplex) - Simultaneous two-way independent transmission in both directions.

FETCH (Character) - Refers to direct access inputs to bring up new characters when called for by resident program instruction (as compared with characters passed

from previous instructions in the sequence). Fetch characters are supplied directly from the current side of the line (send or receive).

FIELD (Display) - For the D-101/D-1001, a field is defined as an area of the CRT displaying an item of interest which may relate to an instruction, command, OPCODE label, operand, or send/receive communication line data, etc.

FILE - Refers to tape files generated to store D-101/D-1001 data. The DOS (Disk Operating System) fields of the D-1001 are used to store file pairs consisting of application programs and related configuration tables. Both source and object programs (and their tables) are filed.

FIRMWARE (User Application ROM) - Refers to software instructions burned into ROM chips.

FLAG - In the D-101/D-1001 a flag refers to a special condition indicator, also to a display on the CRT. The CRT flag display is a black-on-white character as opposed to the normal white-on-black display. Flagged events and conditions include invalid entries inserted in editing and events of special interest with "marker" attributes. Event marks in the D-101 are also "flagged" with flag displays. Five of the EIA interface control inputs are defined as flag controls. These are displayed black-on-white when designated for marking in Configuration Tables. See MARK and MARKER TYPES for additional details.

FRAMING - The process of identifying data bits from the user interface and arranging them into groups to frame characters. Parameters that apply to the input data stream are supplied from the running Configuration Table. The pertinant parameters include: number of bits per character, sync pattern of data and requirements for obtaining sync, parity (if pertinent), or asynchronous inputs with the number of start and stop bits. The framing logic consists of a Receive and a Send unit, both controlled by the application program and the CPU to supply a flow of data to the input buffer and CRT RAM. See IN-SYNC and SYNC (Framing)

FREEZE - A display stop condition initiated by the FREEZE key on the D-101 keypad during Program Run or Program Monitor modes. A running program is not interrupted, and data continues to be transferred into the input buffer. However the CRT display is stopped, and new data will not be displayed until the Freeze is released. Scrolling functions are not enabled. A second depression of the key will terminate the Freeze.

FULL-INTENSITY - Refers to a normal video display on the CRT, meant to signify in this case that the D-101 is synchronized with the incoming data from the user's communication channels.

H

HALF-INTENSITY - Refers to a video display on the CRT at less than normal brightness intended to signify the D-101 is not in-sync with incoming data. Also used to mark Don't/Don't Not characters in data string definition instructions.

HDX-2 - Display option for Level III programs selectable in segment 1 of associated Configuration Table. The HDX-2 selection calls for displaying send data when

the EIA control flag RTS is present (high), and displaying receive data when RTS is absent (low).

HDX-4 - Display option for Level III program selectable in Segment 1 of associated Configuation Table. The HDX-4 selection calls for displaying both send data and receive data in the time sequence in which they appear.

HEX (Hexadecimal) - A numbering system to the base 16, treated in the D-101/D-1001 as a standard character code, acceptable as optional input from user communication lines. Selection of HEX for monitoring CRT displays or simulated output data is controlled by means of Configuration Tables that specify the environment for individual programs. Other coding systems including ASCII, EBCDIC, Baudot, etc., may be converted for display in HEX by pressing HEX keys available on both D-101 and D-1001 keyboards. The HEX digits consist of 0-9 and A-F. In the D-101 two HEX digits are employed for the HEX data code and for inserts as parameters and operands etc. See Appendix H for ASCII and EBCDIC system relationships and conversions to HEX.

HIGH-LOW (Interface Equivalent) - This refers to high-low polarity standards for data bits from the user's communication channels received via the EIA interface. The standards are as follows:

Normal Polarity
1 = low at EIA interface
0 = high at EIA interface
Non-Standard Polarity
0 = low at EIA interface
1 = high at EIA interface

HOME - A cursor and paging control for D-101/D-1001 CRT displays. It refers to the beginning or start point of enterable fields. Used only in scrollable modes. When the HOME key is pressed the cursor will be positioned to the first character of the first enterable field.

I

IMAGE MODIFIERS (Attributes) - The Image Modifiers consist of attribute bytes stored with each character to control the delineation of the character on the CRT screen as follows:

A0 - Blank (LSB) old/new data
A2, A1 - 0, 0 = HEX
0, 1 = ASCII
1, 0 = EBCDIC
1, 1 = USER.
A3 - Reverse video (Marker)
A4 - Underline (Receive data)
A5 - Low Intensity (not in-sync)
A6 - Dot (missing data)
A7 - Shift to Upper Case

INPUT BUFFER - A buffer for the user's interface input. Also called the Data Buffer, it is part of D-101 RAM memory.

INSTRUCTIONS - In the D-101/D-1001, instructions are the basic components of source program software. A range of instructions are provided and arranged in sets according to three levels. To assist in program development, necessary information and terms of usage are included. Information consists of OPCODE name, required operands for each instruction, and a description of the functions as they relate to a program. See LEVELS I and III, OPERANDS, PROGRAMS and PROM for further information.

IN-SYNC - Synchronization of the D-101 with data inputs is required to enable framing of data characters. For asynchrous inputs, start/stop bits with each character automatically lock the D-101 in sync with data. For synchronous transmission a pattern of Hex characters is employed to establish sync. The pattern may consist of either one or two characters and requires only a single occurrence. For SDLC (Synchronous Data Link Control) transmission, a pattern of 0111 1110 is received preceding and following each transmission.

INTERACTIVE - Refers to jointly interactive relationships. Interactive functions of the D-101/D-1001 consist of Send and Receive data transmissions in Modem Simulation mode and Terminal Simulation mode. Also the D-1001 and D-101 share interactive relationship in downloading PROM programs for operations in a dynamic mode. For further reference see SIMULATE (TO MODEM and TO TERMINAL).

INTERFACE CONNECTIONS - The D-101 interfaces with user's communication lines via a MODEM connector and a BUSINESS MACHINE/RCU connector located on the rear panel of the D-101. Refer to Section 3 and Appendix J for details.

INTERRUPT (Timer) - A program instruction to designate an interrupt timer. The timer instruction will interrupt a user program after nn seconds and cause the program to branch to a specified Label.

J

JUSTIFY - a printing term meaning: to set type in full lines, to create straight margins as in "right and left justify". For the D-101/D-1001 the term "justify" applies to CRT display pages of the Configuration Table, shown with prompts and requiring insertion of framing parameters. Insertion of parameters for Start/Stop character framing with related data characters of less than 8 bits requires that the data be right justified (inserted as far as possible to the right).

K

KEYBOARD (HEX) - The D-101 employs a hexadecimal keyboard consisting of 32 miniaturized pushbutton switches with labels. Refer to Appendix E for details.

L

LABEL - A program sequence location identified for convenience by a name rather than by an absolute sequence number. Labels are used to identify destinations that can be reached by branching or jump instructions. Output messages within the user program are defined by labels.

LEAD STATE - A status display on the D-101 CRT, available by key selection. The display shows status of 12 EIA leads. Refer to Appendix D for details.

LEVEL I, LEVEL III - Refers to user application programs for checkout of EIA communication lines that interface with the D-101. The Level I package consists of a software instruction set, limited in scope, to permit programming of simple tasks in the field. These include matching on character strings, outputting data strings, and timing and counter functions.

Level III source and object programs are developed in the D-1001 from a larger instruction set. The object programs are inserted (by burning) in PROM firmware modules. The completed PROM modules operate in the D-101 to perform one or more test programs in a specific communication environment. A number of PROMS can be carried into the field with the D-101, thus providing a series of diagnostic tests that are performed in a nearly automatic manner. Level III programs may also be downloaded directly from the D-1001 to D-101 memory using an inter-unit cable.

LIST - A set of computer instructions arranged in a logical sequence with all available details for checking, debugging, or review.

M

MARK (Character) - Refers to Level III instructions SEMRK (set mark) and TEMRK (test mark). Characters passed to the SEMRK instruction have their marker attribute set, and the same character is then passed to the next sequential instruction. Characters passed to the TEMRK instruction are examined for marker attributes, 0 or 1. If a 0 (reset) is found the program proceeds to the next set. If a 1 (set) is found the program branches to "Label".

MARKER - A means of identifying special characters in the data stream. Setting the marker flag causes a character to be displayed in negative video (black on white). The EVENT MARK key on the D-101 keyboard provides a manual method of selecting and marking characters for display.

MARKER TYPES - In general markers are applied to characters selected in Configuration Tables, in data strings, and from the monitored data stream during active program participation. Characters selected for marking in Configuration Tables include the RS-232 controls: RTS, CTS, SQ, CD, and TP. Also odd or even parity results may be marked. The EVENT MARK key on the D-101 keyboard is used to mark the last character of a data string, also to mark special characters from the interface currently being framed. The D-101 also provides marking of characters by half-intensity display for out-of-sync conditions or Don't/Don't Not matching.

MASK - A mask is an operand employed in match instructions to enable selective comparison by selecting and segregating individual bits of primary importance found in input data characters. Bits of no importance for the comparison are ignored during the process. The Mask operand itself does not participate in the comparison. However the Mask has already determined which bits out of the input character are to be compared with the pattern (or criterion) byte.

MATCH (Under Mask) - A Level III program instruction that provides a range of selectivity for match operations by excluding all bits that are not significant.

The match is successful if significant bits match, and the character passed to this instruction is then passed to the next instruction. The instruction handles up to 8-bit input characters. Operands are pp and mm. The pp operand inserts one or two Hex digits of 4 bits each. The pp operands are the pattern or criterion bits inserted for matching with the data. The mask operands "mm" are also 4-bit bytes. The mask insert consists of 1's to designate significant bits and 0's to represent bits of no interest.

MASTER - Refers to Master ROMs employed by the ROM Programmer in the manufacture of Level III PROM modules. This manufacturing process follows the development, editing, and compiling of a set of test programs and their transferral to the PROM Buffer in the D-1001. The contents of the PROM Buffer are then loaded into the Master ROM, which is located in the MASTER socket on the D-1001 front panel. Loading is controlled by the PROG MAST key on the keyboard. After checkout and verification, the Master ROM is available as a source of data for programming (burning) blank ROMS located in the DUPLICATE socket on the front panel.

MATCH (Exclude) - A match instruction with defined data strings and an exclude character bit. The exclude bit is employed to mask bits that are not significant for this routine. The exclude can be applied to such things as the imbedded start or stop bits employed in asynchronous data transmission.

MINIMUM ENTRY - Refers to abbreviated operands employed in the D-1001 to identify program instructions and commands. The following are examples: L for List, G for GOTO, T for Time, and FIND for FINDX. These operands are each defined as a minimum entry acceptable to the processor for instruction definition.

MNEMONIC - A short abbreviated name code for program instructions and commands, selected as a prompt and as an aid for remembrance.

MODE - Refers to an operational phase or sequence. In the D-101, primary control is invested in Command mode, entered after power up. By pressing the COMMAND MODE key a menu of operational modes is displayed. All operational modes may be entered from Command mode if the system is available or not otherwise engaged. Also, all control can be returned to Command by pressing the COMMAND MODE key after the present operation is completed.

MODEM CLOCK - The source of modem timing and clock signals transmitted to the receiving end of a communication channel to maintain sync. Modem clocks are employed in synchronous transmission sent with the data in sidebands or on separate leads.

MODULE - Refers to PROM Module (also known as ROM Module) - a customized firmware unit ready for insertion into the D-101's Program Load Port and capable of operating the D-101 for RS-232 communication channel testing in accordance with defined communication-line environment. See MASTER for other details.

N

NEGATIVE VIDEO - Refers to a video CRT display of black on white rather that standard white on black. This is a special-purpose display to mark or flag special events or conditions for the viewer.

NORMAL (Bit Order) - See BIT ORDER.

O

OBJECT BUFFER - The storage location of programs and configuration tables after compiling is complete. This is a general memory area since there is no object buffer per se.

OPERAND - The fundamental quantity on which a mathematical operation is performed. Operands are inserted with instruction OPCODES during the development of source programs.

OPTION MODULE - This refers to any device that can be plugged into the D-101 Option Module Cavity to make use of the D-101 processor, CRT, keypad, and input/output devices.

P

PARAMETER - Refers to a quantity, identity, function or other variable that characterizes a system and its working environment. The parameters of major importance to the D-101/D-1001 are those associated with the user's EIA communcation lines. For each comunication line a Configuration Table is generated listing all pertinent parameter values that apply. An applicable line test (program) and configuration table are combined as a file pair to operate the D-101 Datascope. See CONFIGURATION TABLE for further details.

PARITY (Bit) - A checking device to evaluate the accuracy of data transfer through circuits and transmission lines. Parity is used with binary message data by means of an extra bit added to each character. The extra "parity" bit is added to standarize all message characters to all odd or all even (by option). This refers to the sum in each character of 1's digits (0, 2, 4, etc. or 1, 3, 5, etc.). Parity is achieved by adding either a 1 or a 0 bit as needed at the end of each character. The FRAMING prameter accomodates the D-101 Parity requirements. Any discrepancy found in the parity check at the receive end will then indicate a transmission error.

PROGRAM - A set of instructions arranged in a proper sequence for directing the D-101 in performing a desired operation or operations. (See LEVEL I, LEVEL III for more details on user application programs.)

PROGRAM (Run/Wait) - A program option dealing with Output routines. A program wait instruction, provided in Level III programs, fetches characters from the current side of the line until all output is complete. This will interrupt the main program until the output routine is completed. The alternate option is to continue the main program, running concurrently with output routine.

PROM - Programmable Read Only Memory, employed in the generation of the PROM modules (also known as ROM Modules). See PROM MODULE.

PROM MODULE - A customized module board (also known as a ROM Module) designed for easy insertion into the Program Load Port of the D-101. Each PROM Module contains individual firmware generated in the D-1001, which is designed to operate the D-101 in test sequences for a specific communication line environment.

PROMPTS - The D-101 uses "Prompt" displays to assist in operation, program editing, and the construction of Configuration Tables. Prompts consist of editing aids in the form of insertion options, sequence outlines, as well as notices of invalid entries and instructions for correction of alternate entry possibilities. The prompts also check entries for inserts that have exceeded limits. See EDITOR and CONFIGURATION for application of prompts.

PROTECTED/UNPROTECTED - Refers to shielding or prohibits against changes in program structures. This protective control is applicable when Message Edit mode is employed for Level III programs. The Message Edit mode is valuable for minor changes such as for addresses for several terminals that require the same test. The address operand is unprotectd in these circumstances since major aspects of the program are unaffected. However program routines must not be changed. These are protected from changes in Message Edit mode.

PROTOCOL - A general name for any unique combination of a group of data communication characteristics that include speed, framing, sync pattern, code, etc.

R

RAM - Random Access Memory - Working memory of the D-101 used to read and write data.

REMARK LINE - Line 9 on the D-101 CRT display is assigned in Run Program mode for user remarks if any are available. User Remarks are provided only for Level III program operation and are displayed only in Run Program Mode.

REMARKS (PAGE) - This feature, which applies only to Level III user programs, is used to depict program flow or explain significant test results. It may consist of up to four pages of remarks. These will be displayed after the Level III program is completed and will require operation in Page Remark Mode.

REPEAT (RPT X) - a Level III Program Instruction - compares the character passed to it by the previous instruction, with X. If they do not match the character is passed to the next sequential instruction and the process repeats. If the character and X do match, the character is discarded and the next character is fetched from the line and tested. The process repeats until a character is found that does not match with X. This character is then passed on to the next sequential instructions.

RESET - Return to zero state as in set/reset. In the D-101 both software and hardware resets are employed. The software counters and timers (2 each) are not automatically reset.

RSTCK (Reset Internal Subroutine Stack) - A software reset instruction used in Level III programs which employ an internal subroutine stack. The Subroutine Stack is a retain address file maintained for GOSUB branching to subroutines and sub-subroutines etc.

ROM (Read Only Memory) - employed in the D-101/D-1001 for system use with application programs, etc.

RS-232 - Published communication line standards issued by Electronic Industries Association. A standard for communication lines used between Data Terminal

Equipment and Data Communication Equipment (modems). The D-101 is designed to interface and monitor communication lines conforming to these standards.

RTS (Switching) - Refers to RS-232 terminal control lead (Request to Send) used to request permission to transfer data via transmission line to the modem. Protocol requires that the modem control, CTS, be low before RTS can be conditioned to ON (high). For simulated data transmission the option for RTS ON continously will enable the transmission rate to be automatically controlled by the modem. See CTS DELAY for other details.

RUN MONITOR MODE - In this mode, the D-101 operates as a passive line monitoring device. (Bridged connection to the interface prevents interference with the line.)

RUN PROGRAM MODE - This is the program application mode of the D-101 to which all other functions are subordinate. In Run Program mode either Level I in-residence programs or Level III PROM Module programs are executed, providing active and/or interactive testing and monitoring of communication line data.

S

SCROLL - Scrolling refers to up/down movement of the CRT displays. The scrolling controls on the D-101 consist of: PAGE UP, PAGE DOWN, up arrow, down arrow (up or down one line space), and HOME (pages rolled back to the display field beginning).

SDLC (DIR/NRZ) - Refers to decoding functions of the Synchronous Data Link Control series (employed in IBM's compatible general-purpose terminals). SDLC (DIR or NRZ) are synchronous framing options selectable in Level I and Level III Configuration Tables.

SEND DATA - (SD) Refers to user's communication line data originating from Terminal equipment and transmitted via the RS-232 lead BA to a modem.

SET (as in Set/Reset). Refers to a stop or an activity that results in the establishment of a condition, for example "to set the framing for a synchronous data input".

SIMULATE (TO MODEM, TO TERMINAL) - A test procedure of the D-101 used to isolate one side of a communication line by replacing messages and control signals on the isolated side with data and controls supplied by programs resident in the D-101. See TO MODEM and TO TERMINAL for additional details.

SKIP (Skip n Characters) - A program instruction employed in both Level I and Level III software packages. The SKIP routine ignores nnnnn characters fetched from the current side of the line and passes the first character after nnnnn to the next sequential instruction.

SOFTWARE - Programs, languages, and procedures of a computer system. In the D-101 includes programs run to monitor and test user's communication channels. These software programs are developed in the D-101 from a Level I instruction package and in the D-1001 from a Level III package. See LEVEL I, LEVEL III, PROM MODULE, and PROGRAM for further details.

SOURCE BUFFER - In the D-101 this is a 60-line buffer used for development of Level I Source programs. Program instructions are loaded (inserted) into the buffer via the HEX keyboard with the aid of "Prompt" displays on the D-101 CRT. The buffer is located in D-101 memory areas.

STACK - A software storage device. A stack provides for temporary storage and retrieval of successive bytes of information. A stack pointer is provided by the processor to identify the current storage location of the stack. For the D-101/D-1001 an internal subroutine stack is employed with GOSUB branching instructions to store return addresses of subroutines and sub-subroutines. Also Stack storage of 1-15 characters is employed for matching by an MSTK instruction. See MATCH and RSTCK for further information.

STORED CHARACTER - Refers to characters received from user's communication lines in Run Program mode. This input data is stored in the data buffer and also displayed on the D-101 CRT. If the program display is interrupted to show CTR/TMR or LEAD STATE status, etc, the complete input consisting of stored characters is still available in an endless loop format of up to 2048 characters.

STRING DATA - In the D-101 string data consists of data characters inserted into source programs as parameters of data field instructions. The strings of data may be one line or more depending on space allotted in the source buffer, which has storage available for 60 lines. String data may be linked together in a series. The end of a string is indicated by marking with an event mark (flagged for reverse display). String data is inserted into the source buffer by means of the HEX key pad and with assistance of the CRT display. String data is used in matching routines and in output instructions of simulated data etc.

SUPPRESS - To avoid filling the data buffer of the D-101 with superfluous idle pattern characters (or any other repetitive character), a suppression feature can be invoked by selecting SUPPRESS in the Configuration Table.

SYNC CHARACTER - Required for framing of data characters transmitted in a synchronous format. The sync character separates and defines individual data characters by providing its own identity, after which the data characters will follow in a standard pattern of 5-, 6-, 7-, or 8-bit sequences, depending on user selection. The sync character selected is usually of a unique pattern, differing from normal transmission groups with which it might be confused. One or two syn characters may be used; however, a single occurrence of whichever is selected is all that is required to establish sync. See IN-SYNC and SYNC RESET.

SYNC (FRAMING) - Refers to the requirment for synchronization of receiving equipment with sending equipment in order to identify and frame characters in an input data stream. For the D-101 there is an added requirement: to establish the type of synchronization for insertion in a Configuration Table with other parameters related to the transmission channel. The Configuration Table is used to supply sync parameters for the Send and Receive channels of the framing logic. These channels are programmed to analyze and frame data accordingly as instructed. See ASYNCHRONOUS, SDLC, and FRAMING.

SYNCHRONOUS - Refers to data transmission with one or two sync characters to identify the pattern of character transmittal plus a modem-clock or other timing signal to establish synchronization. Start and stop bits are not used.

SYNC RESET - When an out-of-sync data display (half-intensity) appears on the D-101 CRT, the SYNC RESET key is used to initiate a release in the framing circuits at the present sync pattern and start a search for sync character(s) to obtain new sync. An alternative approach for maintaining sync is the generation of periodic resets. These are programmed by insertion of a hex character via the Configuration Table to initiate a reset periodically when the character is supplied to the framing logic. See SYNCHRONOUS.

SYNTAX - A relationship among characters or character groups or rules governing the structure of a language. The syntax relationship of the D-101/D-1001 refers to the system control and command structure, both manual and software, as it affects operating modes and functions. In particular, syntax applies to the use of the Level I and Level III Instruction packages and the applications of keyboard controls.

T

TERMINATED - Refers to an electrical load attached to the end of a line to equal the characteristic impedance of that line.

TEST, CONFIDENCE - Refers to internal diagnostic tests employed to identify and locate operational problems and to verify operating conditions in the D-101/D-1001. These are software programs performed automatically without operator intervention. Individual test cycles are indicated by test completion messages.

TIMER - Provides a program time count in milliseconds which repeats after 65535 ms. Two counters are available for D-101 and two for D-1001 software. Counter instructions are inserted with other program data via the keyboards. Level I instruction sets include timer start, test, reset, and increment functions. Level III instruction sets include timer jump, reset, interrupt, branch, test, compare, and stop functions. A display of timer status (not updated) combined with the count in the software event counters is available on the D-101 CRT during Program Run mode, also in Monitor and Stop modes, by pressing the CTR/TMR key switch.

TO-MODEM - Refers to simulated test data and/or control signals sent to a modem (data set). This operation is performed to isolate and analyze transmission to and from a data set without the intervention of data or controls from the terminal link. See SIMULATE (TO MODEM, TO TERMINAL) and RTS DELAY.

TO TERMINAL - Refers to simulated test data and/or control signals sent to a terminal. This operation is performed to isolate and analyze transmission to and from a terminal without the intervention of data or controls from a modem link. See SIMULATE (TO MODEM, TO TERMINAL) and CTS DELAY.

U

UTILITY (Executive) - Refers to usable features. For the D-101 the Executive Utility comprises all the internal system functions subsidiary to Program Run operations.

USER PROGRAMS - Refers to application programs designed for or by the D-101 user for testing or analysis of operation of the user's communication channels (type RS-232). Applications programs are classified as either Level I or Level III, and in general, Level III programs are more complex and more powerful than Level I programs. (Level II does not presently exist as a D-101 program type.) Level I programs are keyed into D-101 RAM memory circuits via the front panel keyboard while the D-101 is in Edit mode. (See Appendix F for details.) Level III programs are developed, and "burned" into a PROM module, in the D-1001 Program Development System. The PROM module is then plugged into a socket in the D-101 front-panel drawer, and a Level III program (with associated configuration) is loaded and made ready to "run" by simply pressing several keys on the D-101 front panel. (See Section 4E for details.)

V

VECTOR - A program option checked as needed during run sequences to evaluate its status and determine the effect on future routines.

X

XMIT BUFFER (Area) - An output buffer area in the D-1001 memory circuits employed for transferring object programs directly via cable (downloading) to the D-101 In the D-1001, programs are loaded immediately after compilation into the XMIT buffer and also into the PROM buffer. See DOWNLOAD.

D-101X DECODE/DISPLAY FACILITY FOR BIT-ORIENTED PROTOCOLS

(SUPPLEMENT TO D-101 OPERATOR'S MANUAL)

April 1983

TABLE OF CONTENTS

Section		Page
1.	**GENERAL INFORMATION**	
	PURPOSE OF THIS SUPPLEMENT	S1-1
	APPLICABILITY	S1-1
	RECOMMENDATIONS FOR USING THIS SUPPLEMENT	S1-1
2.	**INTRODUCTION TO DECODE/DISPLAY FACILITY**	
	WHY THE DECODE/DISPLAY FACILITY EXISTS, AND WHAT IT DOES	S2-1
	The Situation	S2-1
	The Problem	S2-1
	The Solution	S2-1
	GETTING FAMILIAR WITH THE D-101X DECODE/DISPLAY FACILITY	S2-1
	Decoded Versus Undecoded Data Displays -- A Comparison	S2-1
	Basic Facts Needed to Understand Undecoded and Decoded Displays	S2-2
	Decoded Dynamic Display of Live Data	S2-3
	Decoded Static Display of Trapped Data	S2-4
	Page 4 of the Configuration Editor - An Introduction	S2-4
3.	**OPERATING PROCEDURES**	
	MONITORING DATA	S3-1
	RUNNING A ROM (LEVEL III) PROGRAM	S3-4
	RUNNING A USER-ENTERED (LEVEL I) PROGRAM	S3-6
4.	**CONFIGURING AND READING DISPLAYS**	
	CONFIGURING THE DECODE/DISPLAY FACILITY TO SUIT YOUR PURPOSES	S4-1
	Entering Configuration Options (A Familiarization Exercise)	S4-1
	HOW TO READ DECODED DISPLAYS OF FRAMES AND PACKETS	S4-2
	Using Table S4-1	S4-3
	Using Table S4-2	S4-3

LIST OF ILLUSTRATIONS

Figure		Page
S4-1	Configuration Editor Page 4 - Parameter Entry	S4-5

LIST OF TABLES

Table		Page
S4-1	Frame Decodes	S4-7
S4-2	Packet Decodes	S4-9

1. GENERAL INFORMATION

PURPOSE OF THIS SUPPLEMENT

This supplement is intended to help you understand and effectively use the DECODE/DISPLAY facility of the D-101X.

APPLICABILITY

This supplement is applicable only if all of the below-listed conditions exist. Otherwise, use the operating instructions and other information contained in the main body of the D-101 Operator's Manual and its Appendixes A through L. Those conditions are:

1. You are operating a D-101X (the D-101A does not have the decode/display facility).

2. You are working with one of the following protocols, or a variation thereof: X.25; X.75, modulo 8; X.75, module 128; Bisync X.25; SDLC; HDLC; or ADDCP.

3. You choose to use the decode/display facility. (You can use the "normal" undecoded display if you so desire; however, the decoded display is much better suited for working with bit-oriented protocols.)

4. You have a reasonable understanding of how to operate the D-101 as described in the D-101 Operator's Manual and its appendixes A through L. In particular it is assumed that you can:

   (a) Establish an appropriate data configuration to match the online data

   (b) Trap online data of interest in the input buffer

   (c) Invoke the type of data display you want (excluding the bit-oriented decode facilities)

   (d) Examine the input buffer contents in the STOP mode

5. It is further assumed that you know the meaning of the display attributes (underline, dummy dot, negative video, etc).

RECOMMENDATIONS FOR USING THIS SUPPLEMENT

Start by reading Section 2. It provides the background information every D-101X operator needs to understand what the decode/display facility is, why it exists, and what it can do for you.

Section 3 is intended for use by occasional or inexperienced operators who have to deal with bit-oriented protocols. This section provides step-by-step instructions to monitor data, run a ROM (Level III) program, and run a user-entered (Level I) program.

Examine and become familiar with the contents of Section 4. It provides illustrated and tabular reference materials that summarize the details you need for setting up (configuring) the decode/display facility and reading the displays it produces. It also provides text explaining how to best use the illustrated and tabular material.

2. INTRODUCTION TO THE DECODE/DISPLAY FACILITY

WHY THE DECODE/DISPLAY FACILITY EXISTS, AND WHAT IT DOES

The Situation

Data communication networks of today are far more versatile and efficient than those of the past, even the recent past. In addition, data transfer is becoming increasingly error free. In large measure these technical gains are the result of the introduction of bit-oriented protocols such as X.25, X.75, Bisync X.25, SDLC, HDLC, and ADDCP.

The Problem

In general, bit-oriented protocols employ control frames to establish a physical communication link and use packets to convey control information. For an electronic digital device the use of bit-oriented protocols is both efficient and easy to deal with. To a human operator, however, the technical details of bit-oriented protocols are confusing, hard to learn, and hard to remember. In addition, it is difficult to interpret a display of online data expressed in traditional codes such as ASCII, EBCDIC, or even HEX. This is because meaningful pieces of information are contained in fields that do not constitute a character in any of those codes. For example, a modulo eight X.25 information frame whose send sequence number, N(S), is 02 consists of the following bits:

XXXX010X (X represents a "don't care" bit - it may be either 0 or 1.)

Thirty-two different hex-pairs have "010" in the bit positions noted above. Similar situations exist when the data is displayed in ASCII, EBCDIC, or any other code framed in seven or eight bits. The possibilities of confusion and erroneous interpretation are both obvious and many.

The Solution

Since the information contained in control frames and packets can be expressed in human language, why not use the power of a microprocessor to do the tedious work of interpreting those cryptic codes, and then present a display in plain human language? In addition, why not have the microprocessor also do the work of eliminating (from the display) those parts of the data stream that do not interest you, and highlighting those parts of the data stream that are of particular importance to you? Suppose, in addition to all that, the entire data stream could be captured in memory and later examined with either the same or a different choice of frame types and/or packet types and with different items highlighted. The Decode/Display facility of the D-101X does all of that, and more.

GETTING FAMILIAR WITH THE D-101X DECODE/DISPLAY FACILITY

Decoded Versus Undecoded Data Displays -- A Comparison

An overall look at operation of the D-101X Decode/Display facility reveals that it operates much like the normal (undecoded) data displays provided by both the D-101A and D-101X. The same general types of display functions are affected by the same front-panel control keys, and the same configuration parameters that affect the undecoded display (of the D-101A and D-101X) also affect the decoded display (of the D-101X). (The CODE, SUPPRESS, MARKER, and DISPLAY parameters affect both the undecoded displays and the decoded displays).

Pages 1 through 3 of the configuration editor for both the D-101A and D-101X are identical in form and function. The major difference is that the D-101A does not have a page 4 in its configuration editor display, and page 4 of the D-101X configuration editor display applies only to the Decode/Display facility. The D-101X Decode/Display facility simply goes much further in doing the same sort of thing that the undecoded display facility does.

Basic Facts Needed to Understand Undecoded and Decoded Displays

During normal online operation in Run Monitor Mode or Run Program Mode (undecoded display) a DATASCOPE does, among many other things, the following:

1. Beginning when sync or framing is established, copies all online data to the input buffer (memory)

2. Writes newest data over oldest after the buffer fills. (In D-101X, standard buffer capacity is 8K.)

3. When Run Monitor or Run Program Mode is invoked, clears the input buffer before the first new online character is stored

4. Beginning when sync or framing is established, presents a CRT display of each data character when it appears online. If you use the FDX display, all online characters appear on the CRT.

5. Presents newest data (characters) in place of oldest when the CRT screen fills with characters

The five items above describe some important functions of a process called "dynamic display" (or run-mode display) of online data.

When you press the STOP key, the stop mode is invoked and the following things occur:

1. The CRT display is updated to show a full screen of the newest data (including the last character detected).

2. The cursor keys (▲, ▼, PAGE UP, PAGE DOWN, and HOME) are enabled, permitting you to examine the entire input buffer contents.

The two items above describe some important functions of a process called "static display" (or stop-mode display) of online data.

The same basic processes occur when you use the Decode/Display facility. it gives you a dynamic display and a static display. The important differences are summarized below:

1. The decoded dynamic display does not show online characters -- it shows internally generated messages that are derived by decoding the online characters.

2. The decoded dynamic display presents only the information type(s) that you previously specified on page 4 of the configuration-editor display -- if frames with address 01 are specified, frames with address 03 (or anything else) will not be shown. However, all online data is stored in the input

buffer and can be viewed later (in stop mode) with the display configured to show the same information type(s), different information types(s) or even an undecoded display if you so choose.

3. The decoded dynamic display uses one display line to show a frame or a packet. It uses two lines to show a frame/packet combination.

4. Messages decoded from the receive side of the line are underlined, and messages from the send side of the line are not underlined.

5. Each new decoded message appears on the next available display line.

6. When the screen fills, the newest decode replaces the oldest.

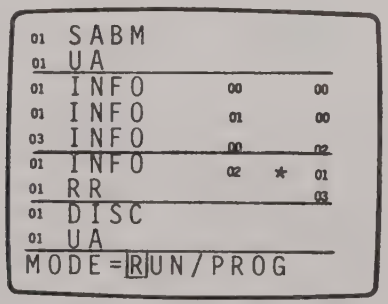
7. The half-intensity block shows where the next decode will appear.

8. The decoded static display shows one frame, one packet, or one frame with a packet included (if the frame did in fact include a packet). As with the dynamic display, the static display shows only the information type(s) that you previously specified on page 4 of the configuration-editor display.

9. Assume that during static display the decode facility is configured to show both frames and packets and that the online data contains a frame with packet included; that frame/packet combination will appear on the CRT with the decoded frame on display line 1, the decoded packet on display line 2, and the related online characters (undecoded) beginning on display line 3. The PAGE UP and PAGE DOWN keys permit you to step through the decoded messages, and the cursor-up-cursor-down keys (▲ and ▼) permit you to step through lines of online characters (undecoded) if the entire undecoded message does not fit on one CRT screen.

Decoded Dynamic Display of Live Data

Depending upon the contents of the data stream and depending upon what you have chosen to look at in that data stream, a CRT screen presented by the D-101X DECODE/DISPLAY facility might look something like the one below.



Note:
The actual CRT display has eight lines on which the decodes can appear. This illustration has nine in order to clearly show all steps of a complete data transaction.

It is easy to see that a link was established, two information frames were transmitted, and two information frames were acknowledged.

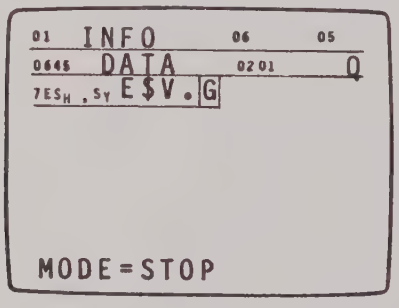
The address field of each frame is on the left, the frame type is next, the third column of the INFO frames shows the N(S), the asterisk (*) appears when the poll/final bit is set, and the last column shows the receive sequence, N(R). Fields not displayed (for a given frame) do not apply.

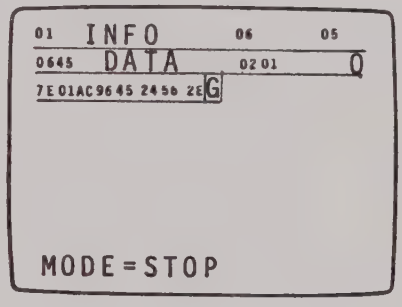
Frames from the receive side of the line are underlined, and frames from the send side of the line are not underlined. The "R" of MODE=RUN/PROG is presented in negative video to indicate that the display is "frozen" (while the program continues to run).

The above example, and the few that follow, show only a small sample of what the D-101X Decode/Display facility will do. The examples are presented here only to help you become familiar with the system. All details needed to understand any display the D-101X is able to produce are provided in Tables S4-1 and S4-2 on pages S4-7 and S4-9.

Decoded Static Display of Trapped Data

After Run Monitor or Run Program mode is terminated (either automatically by the program or manually by pressing the STOP key), the CRT automatically shows the last frame and/or packet that was decoded for display. If you are decoding frames and packets (BOTH), that display will look something like one of the samples below (if the last decoded message was a frame/packet combination).



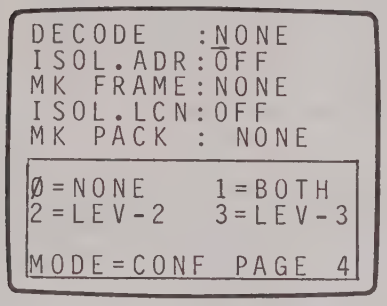


The first and second lines of the static display are identical with the corresponding lines of the dynamic display, the third line of the static display is identical with the corresponding portion of the undecoded (normal) display of the data stream. The sample on the left shows the data stream (third display line) in ASCII, the one on the right is in hex. (Press HEX key to alternate the data stream portion of display between hex and the currently configured code, which in this case is ASCII.) If you are decoding frames only (LEV-2), display line 2 will be blank. If you are decoding packets only (LEV-3), display line 1 will be blank. The undecoded (normal) display will be shown whether you are decoding frames (LEV-2), packets (LEV-3), or both frames and packets (BOTH).

The PAGE UP and PAGE DOWN keys enable you to step through the messages in the input buffer; if a given message is larger than a screen, the cursor up and cursor down keys enable you to step through the lines of that message.

Page 4 of the Configuration Editor -- An Introduction

Page 4 of the configuration editor is devoted exclusively to the selection of parameters that control the Decode/Display facility. When the D-101X is powered up, and when the Decode/Display facility is not in use, page 4 of the configuration editor looks like the illustration below.



The functions of the parameters are described in general in the following paragraphs. During the actual selection of these parameters, appropriate prompts appear (in the negative video area of the screen) to show you the acceptable choices.

As you enter a parameter it is automatically checked for validity within the framework of the currently selected protocol. If that parameter is valid within the protocol, and if that parameter does not form an illegal combination with a previously entered valid parameter, the entry is accepted. When a parameter is accepted, configuration memory and its display are immediately updated. When a parameter is rejected, the cursor moves to the beginning of the incorrectly entered field and waits for another input. You can not exit from a field until it contains an acceptable parameter.

Purpose of the DECODE Parameter

The DECODE parameter is the means by which you tell the D-101X two very important things: (1) which set of protocol decoding conventions to use when converting the online data to a human language display, and (2) which of the following protocol elements you want to decode and display: frames, packets, both, or neither. The protocol choices currently available to you are: X.25; X.75, modulo 8; X.75, modulo 128; Bisync X.25; SDLC; HDLC; and ADDCP. The decode choices are LEV-2, LEV-3, BOTH, and NONE. (The decode choices are listed in the same order as in (2), above.)

Purpose of the ISOL.ADR Parameter

The ISOL.ADR parameter is the means by which you tell the D-101X the address(es) that must be included in a control frame in order for that control frame to be displayed. Note that selecting an ISOL.ADR parameter of NONE is interpreted by the D-101X as meaning that you want to see all frames displayed, regardless of their address. Also note that the configuration editor disallows entry of an address that is illegal for the previously selected DECODE type.

Purpose of the MK FRAME Parameter

The MK FRAME parameter is the means by which you tell the D-101X which frame type(s) or frame-type group(s) you want highlighted (in negative video) when displayed. Frame-type choices currently available to you are: NONE, INFO, UA, FRMR, SARM, SABM, DISC, RR, RNR, and REJ. Frame-type group choices are: INFO, SUPR,

UNN, and ERROR. Note that selecting an MK FRAME parameter of NONE is interpreted by the D-101X as meaning that you want all frame types and frame-type groups displayed in normal video (not highlighted in negative video).

Purpose of the ISOL.LCN Parameter

The ISOL.LCN parameter is the means by which you tell the D-101X which LCN must be included in a packet in order for that packet to be displayed. Note that selecting an ISOL.LCN parameter of NONE is interpreted by the D-101X as meaning that you want to see all packets decoded, regardless of their LCN.

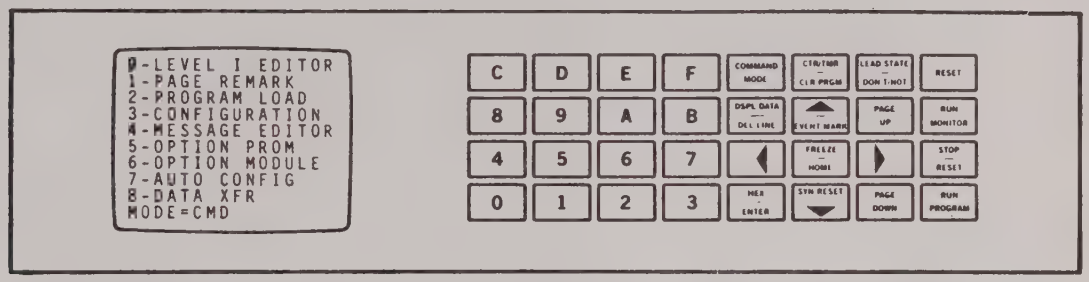
Purpose of the MK PACK Parameter

The MK PACK parameter is the means by which you tell the D-101X which packet type(s) you want highlighted (in negative video) when displayed. Packet type choices currently available to you are: NONE, CALL, FLOW, CLEAR, RESET, DIAG, DA, INT, and RST. Note that selecting a MK PACK parameter of NONE is interpreted by the D-101X as meaning that you want all packet types displayed in normal video (not highlighted in negative video).

Figure S4-1 on page S4-3 provides a summary of all of the details you need to know about page 4 of the configuration editor display. It shows what display options are available to you and it diagrams the parameter-entry syntax required to configure for any type of decoded display that the D-101X is capable of producing.

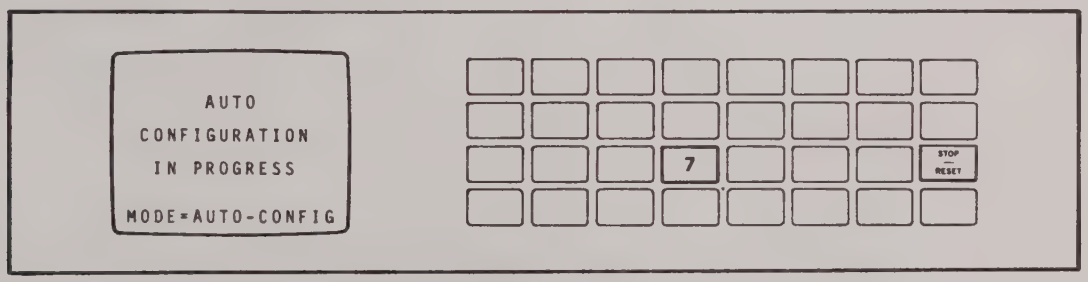
MONITORING DATA

1 Start with the D-101X operating in the Command mode (with menu display) as shown below.

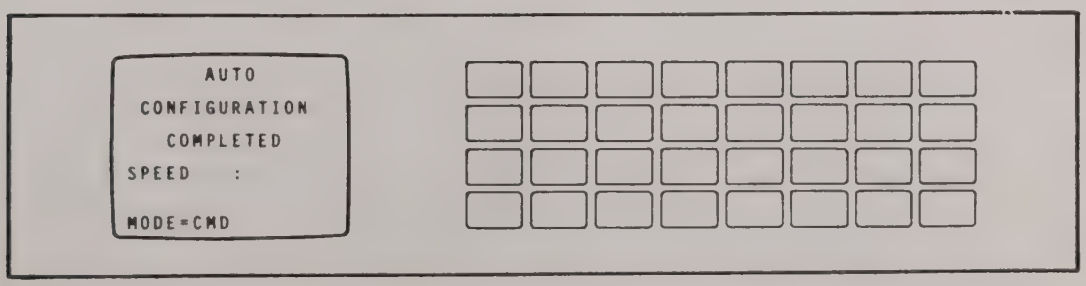


2 Connect the D-101X into the data circuit as shown in Setup 1 of Section 3 of the basic manual.

3 Press the 7 key (to establish the automatic configuration mode) and observe the display "MODE=AUTO-CONFIG" while automatic configuration is in progress.



4 When the automatic configuration process is sucessfully completed, the D-101X prompts "CONFIGURATION COMPLETED" and enters the Command mode as shown below. (No key strokes are required.) If a different prompt is displayed, the automatic configuration process was not successful. If this is the case do either of the following before beginning with step 5: (1) refer to Subsection 4C of the basic manual and manually configure, or (2) refer to Appendix B for an explanation of the automatic configuration process and its requirements. Regardless of which configuration method (above) was used, it did not configure page 4 of the configuration table. Proceed to step 5.



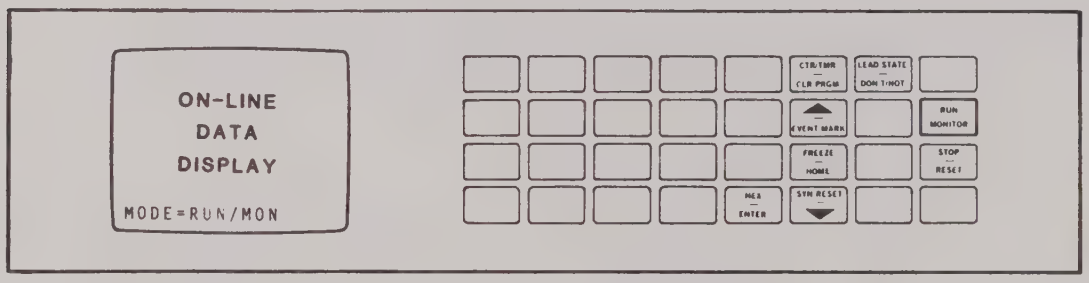
5 If autoconfiguration was successful, press the 3 key and go to step 6. If you configured manually (as described in Subsection 4C) go to step 6 without pressing any key.

6 Use PAGE UP and/or PAGE DOWN key(s) to select page 4 of the configuration editor display.

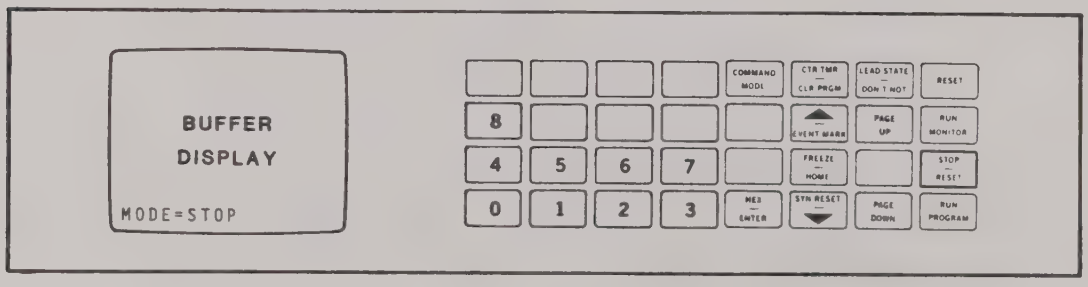
7 Observe the negative-video prompts, and key in parameters that will produce the desired decoded display. For additional help, refer to Tables S4-1 and S4-2 (pages S4-7 and S4-9), which are effectively catalogs of the displays available, and to Figure S4-1 (page S4-3), which is an overall "map" of the parameter-entry sequence.

8 When you have entered all required parameters, press the COMMAND MODE key and observe that the CRT display is updated to include the message "MODE=CMD".

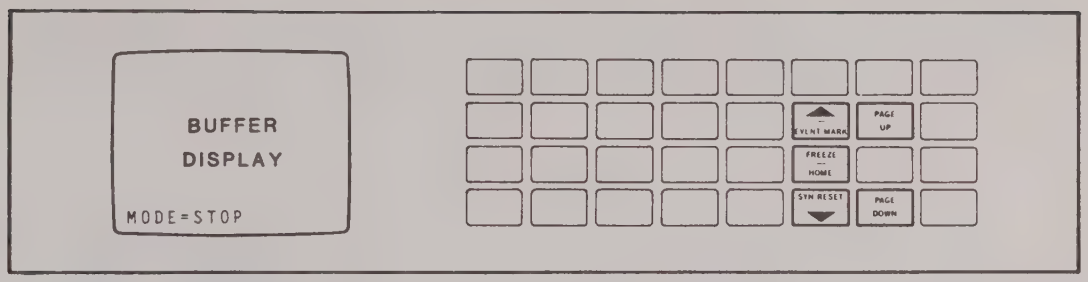
9 Press the RUN MONITOR key (the D-101X enters the Run Monitor Mode), and observe the online data.



10 When online monitoring is completed or when you desire to view the data saved in the input buffer, press the STOP key. The D-101X enters the Stop mode and displays the data most recently read from the data line.



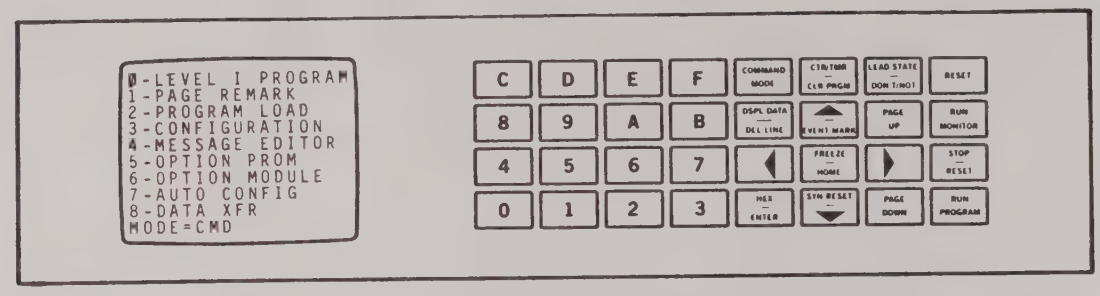
11 In the Stop mode, the group of keys highlighted in the following illustration are used (as required) to permit examination of the entire input buffer contents. The PAGE UP and PAGE DOWN keys enable you to step through the messages in the input buffer that are selected for decoding by the current page 4 configuration parameters. If a given message is larger than a screen, the cursor up and cursor down keys enable you to step through the lines of that message.



12 From the Stop mode you can go back to step 9, which clears the input buffer contents and begins monitoring again, or you can return to the Command mode (with menu display) as in step 1 by pressing the COMMAND MODE key.

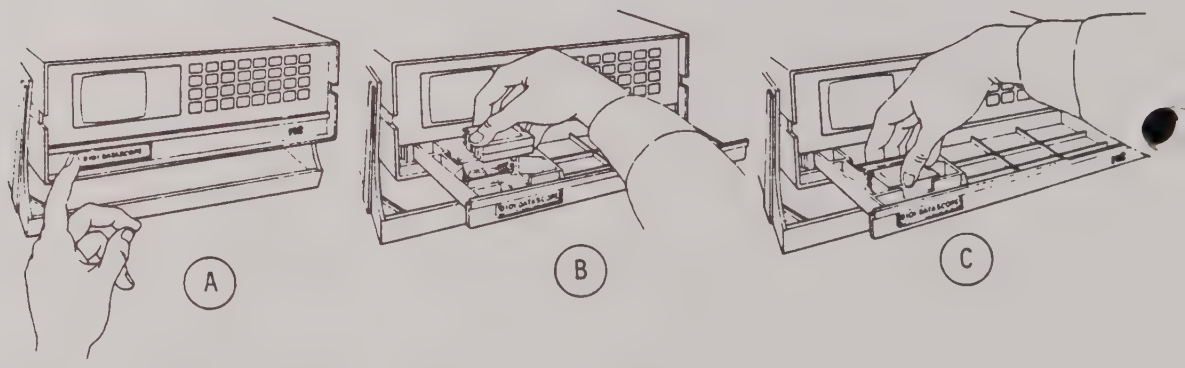
RUNNING A ROM (LEVEL III) PROGRAM

1 Start with D-101X in the Command mode (and showing menu display). This condition is illustrated below.



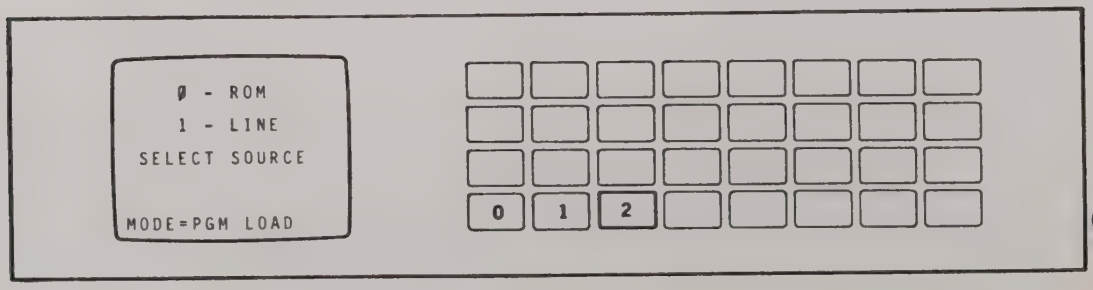
2 Determine which D-101X-to-data-line connection is required for the program you intend to load and run.

3 Install the selected ROM module in the D-101X. (A, B, and C below) and close the drawer.

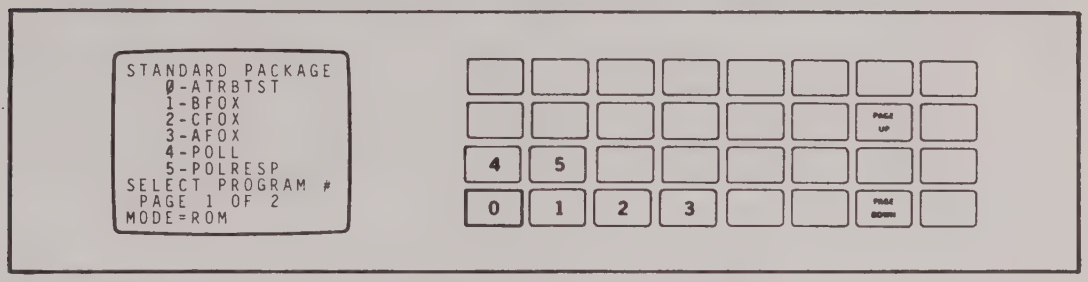


4 Verify that the D-101X is connected to the data line as required for the program to be run. Section 3 of the basic manual illustrates the valid connection alternatives.

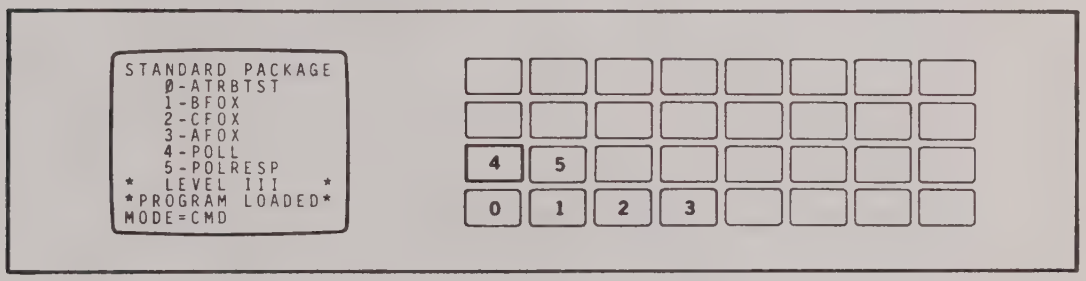
5 Press key 2 to enable the load-from-ROM-module process, and observe the "program load" display.



6 Press the 0 key to display the ROM module directory. Multiple-page directories are viewed with the aid of the PAGE UP and PAGE down keys. (The illustration shows page 1 of the two-page directory read from the "Standard PROM" [P/N 1001875 M04 REV 0] supplied with the D-101X.

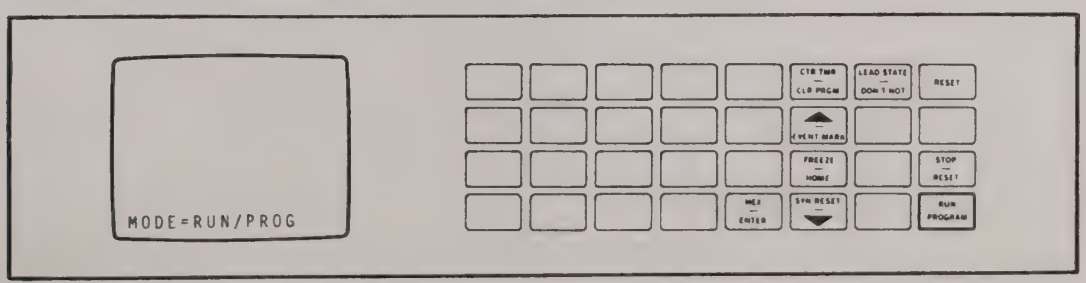


7 Referring to the directory display, press the key with same number as the desired program. When the key is pressed the CRT reports PROGRAM LOADED, and the D-101X returns to the Command mode regardless of which program (number) you select. In the illustration below, program 4 (POLL) was selected.



Note that a ROM-based (Level III) program is able to set "page 4" configuration parameters. Note also that you can call up page 4 of the configuration editor and alter the parameters if you so desire. (Press the 3 key then the PAGE UP key, then enter the desired parameter changes.) If you do change the parameters, observe the negative-video prompts as a guide to parameter selection. For additional help refer to Tables S4-1 and S4-2 (pages S4-7 and S4-9), which are catalogs of the displays available, and to Figure S4-1 (page S4-3), which is an overall "map" of the parameter-entry sequence. When you have entered all required parameters, press the COMMAND MODE key and observe that the CRT is updated to include the message "MODE= CMD.

8 Press the RUN PROGRAM key; program operation begins as described in the documentation associated with the ROM module.



RUNNING A USER-ENTERED LEVEL I PROGRAM

This section describes the procedure for running a Level I user program. Before running this procedure, the following must be done:

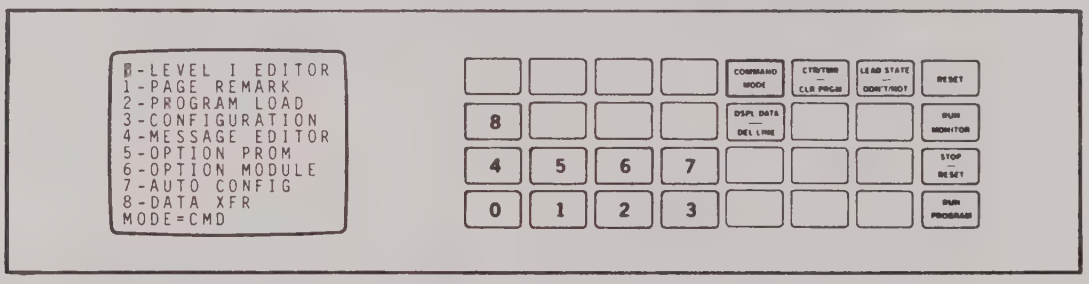
a. The program must be entered (Section 5.A of the basic manual).

b. The appropriate configuration must be entered (Section 4.C for configuration editor pages 1 through 3 and Figure S4-1 (page S4-3) for configuration editor page 4).

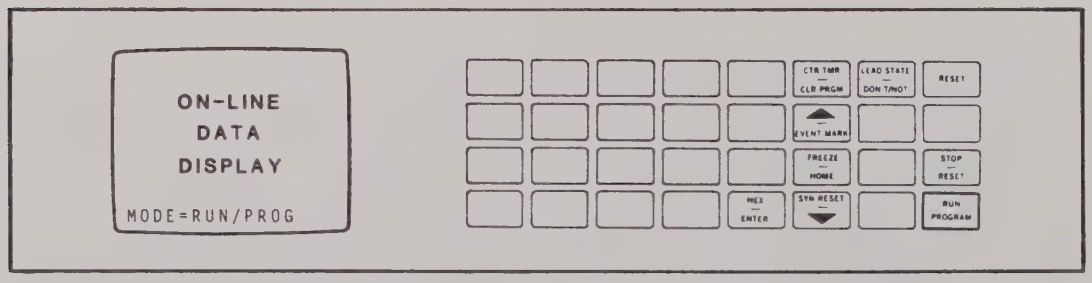
c. The appropriate D-101X-to-data-line connection must be made (Section 3).

The basic procedure is summarized below.

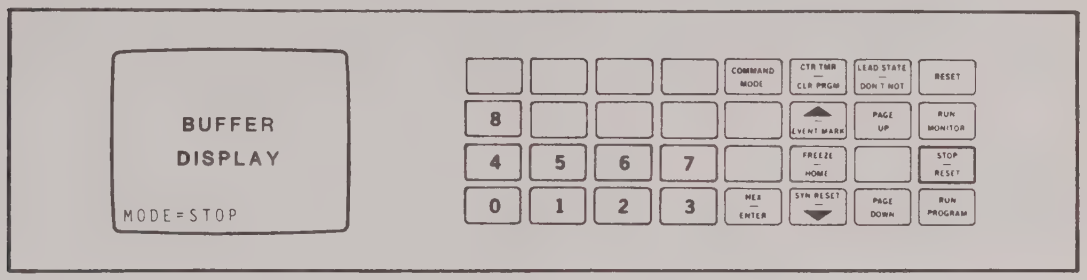
1 Begin with the above conditions satisfied and with the D-101X operating in the Command mode and displaying the menu (as illustrated).



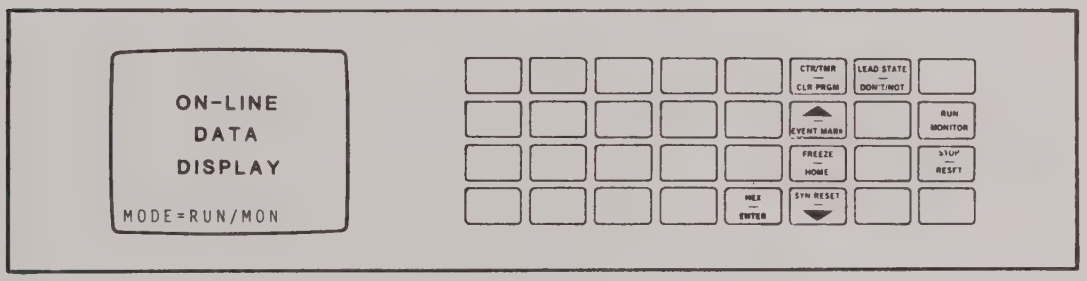
2 Press the RUN PROGRAM key, to begin execution of the user program and to invoke the display of on-line data.



3 When program execution stops (either automatically under program control or by pressing the STOP key when the program objective has been accomplished) the D-101X enters the Stop mode and displays the data most recently read from the data line.



4 In the Stop mode, a group of keys (highlighted in the following illustration) are enabled, in order to permit examination of the entire input buffer contents. The PAGE UP and PAGE DOWN keys enable you to step through the messages in the input buffer that are selected for decoding by the current page 4 configuration parameters. If a given message is larger than a screen, the cursor-up and cursor-down keys enable you to step through the lines of that message.



5 From the Stop mode you can go to step 2, to clear the input buffer contents and run the program again, or you can return to the Command mode (with menu display) as in step 1 by pressing the COMMAND MODE key.

4. CONFIGURING AND READING DISPLAYS

CONFIGURING THE DECODE/DISPLAY FACILITY TO SUIT YOUR PURPOSES

If you understand how to use Figure S4-1 and how it relates to page 4 of the configuration-editor display, two things become evident. One is what you can do with the Decode/Display facility. The other is how to "set" the parameter options to get the Decode/Display facility to do what you want it to do.

Figure S4-1 employs a series of CRT illustrations and a syntax diagram. The CRT illustrations are keyed to points in the syntax diagram. These are used in the procedure below entitled "Entering Configuration Options (A Familiarization Exercise)" in order to step you through the entry of a sample set of page 4 configuration parameter options and help you gain familiarity with Figure S4-1.

Although it is not necessary to use Figure S4-1 to enter a set of page 4 parameter options, the figure will prove very helpful -- especially when you are learning to use the Decode/Display facility. This is because, in Figure S4-1, the entire structure of page 4 parameter-option entry is visible at once. When using the actual D-101X, although all parameter-option entries can be selected from CRT-displayed prompts, the only parameter-entry options that appear on the CRT at any given time are those from which your next choice must be made.

Entering Configuration Options (A Familiarization Exercise)

This procedure is provided to help you gain familiarity with Figure S4-1 and page 4 of the configuration-editor display. It provides step-by-step instructions to enter a "sample" set of page 4 configuration-parameter options. The parameter options set by this procedure will operate with X.75, modulo 128 online data. The combination of parameter options employed by the procedure may have no practical use to you except to illustrate the concepts involved. The Decode/Display characteristics that the procedure will select are as follows:

Decoding conventions employed	X.75, modulo 128
Frames displayed	Those with addresses 01 or 03
Frame type highlighted (in negative video)	DM/SARM (Set Asynchronous Response Mode/ Disconnected Mode) and RR (Receive Ready)
Packets displayed	Those with logical channel number 123 that are associated with a frame whose address is 01 or 03
Packet types highlighted	CLEAR (Clear), CLEAR C (Clear Confirmation), RESET (Reset), and RES C (Reset Confirmation)

Refer to Figure S4-1 and proceed as follows:

1 Call up page 4 of the configuration-editor display.

2 If the DECODE parameter is anything other than NONE, press key 0. The DECODE parameter will change to NONE and the CRT display will match illustration 1 (of Figure S4-1). This is the starting point for the "sample" configuration process. It corresponds to the "1" point noted on the syntax diagram portion of Figure S4-1.

3 Refer to the negative-video prompts in illustration 1. Note that the same prompts appear inside the largest bracket shown in the syntax diagram. In our sample configuration process we have chosen to enter the parameter BOTH. To do this, press key 1.

4 After you press key 1 you are at point 2 in the syntax diagram, and at illustration 2 in the series of CRT displays. It is easy to see (from either the illustration or the syntax diagram) that the next set of parameters from which you must choose are X.25, X.75, and BSCX25. In our sample configuration process we have chosen to enter the parameter X.75. To do this press key 1.

5 After you press key 1 you are at point 3 in the syntax diagram and at illustration 3 in the series of CRT displays. Enter the parameter 128. To do this press key 1.

6 After you press key 1 you are at point 4 in the syntax diagram and at illustration 4 in the series of CRT displays. You have completed the entries that told the D-101X to (decode and) display BOTH frames and packets, and to do this according to the protocol rules of X.75, modulo 128. Note, in illustration 4, that the cursor has advanced to the next configuration item (ISOL.ADR), and that in the syntax diagram you have reached a vertical dash line. This means that you can: (a) quit the configuration process with all parameters set as they are currently displayed, (b) cursor-down or cursor-up to get to the next configuration item you want to change, or (c) proceed with entering parameters for ISOLATE ADDRESS.

7 If you have performed steps 1 through 6, you should have no difficulty with using Figure S4-1 and the syntax diagram to complete the entry of the sample configuration in the same general manner as described above. In our sample configuration process, the next function we have chosen is to isolate on frame addresses 01 and 03. (This means to decode and display only those online frames whose address fields decode as 01 or 03.) No further detailed instructions are provided. Proceed on your own resources, or quit the process of entering the sample configuration.

HOW TO READ DECODED DISPLAYS OF FRAMES AND PACKETS

Tables S4-1 and S4-2 are intended to help you read, and understand the meaning of, CRT- displayed messages produced by the D-101X Decode/Display facility. Table S4-1 is for frames. It includes an illustration of every frame-decode CRT message that the D-101X is able to produce. Table S4-2 is for packets. It includes an illustration of every packet-decode that the D-101X is able to produce.

Using Table S4-1

Table S4-1 employs six columns of frame illustrations. Each of these columns is headed with the name of a protocol. When you use the table to interpret a decoded-frame display, use the column whose heading matches the current setting of the DECODE parameter (on page 4 of the configuration-editor display). This arrangement permits you to match (the mnemonic of) a CRT-displayed frame decode with the corresponding illustration in the table and determine:

1. How to interpret all fields of a CRT-displayed decoded frame. (Do this by reading the note referenced in the "KEY TO NOTES" column.)

2. The binary content of the online data byte from which the frame was decoded. (This is shown in the "CONTROL FIELD" column.)

3. The full, widely known name of the frame type that the menmonic represents (this is shown in the "FRAME NAME" column.)

When a blank space appears in a column of illustrations for a given protocol, and the corresponding bit pattern (shown in the "CONTROL FIELD" column) appears online, that bit pattern is decoded as an invalid frame. Under these conditions, the CRT presents the message "*INVALID FRAME*" in the same place that a valid decode would have been presented.

Using Table S4-2

Table S4-2 is similar to Table S4-1. It is used in much the same way that Table S4-1 is used. The differences are described below. Keep in mind the fact that Table S4-2 applies only to packets.

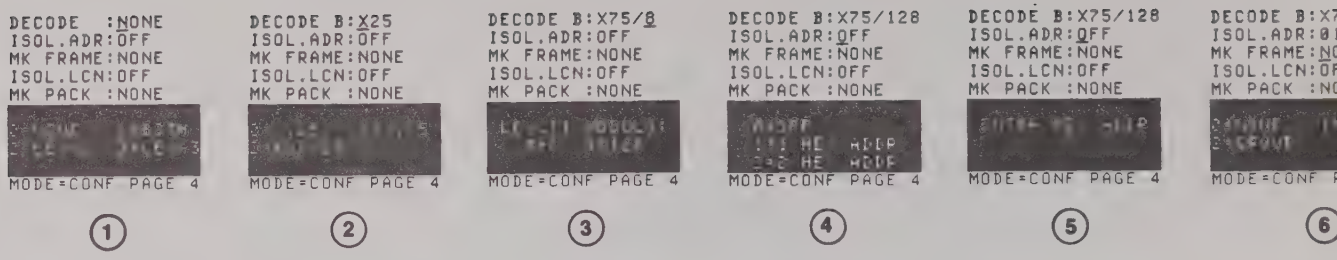
In Table S4-2 there is one column to show the illustrations of decoded-packet displays, and six columns to show the digital content of the online data.

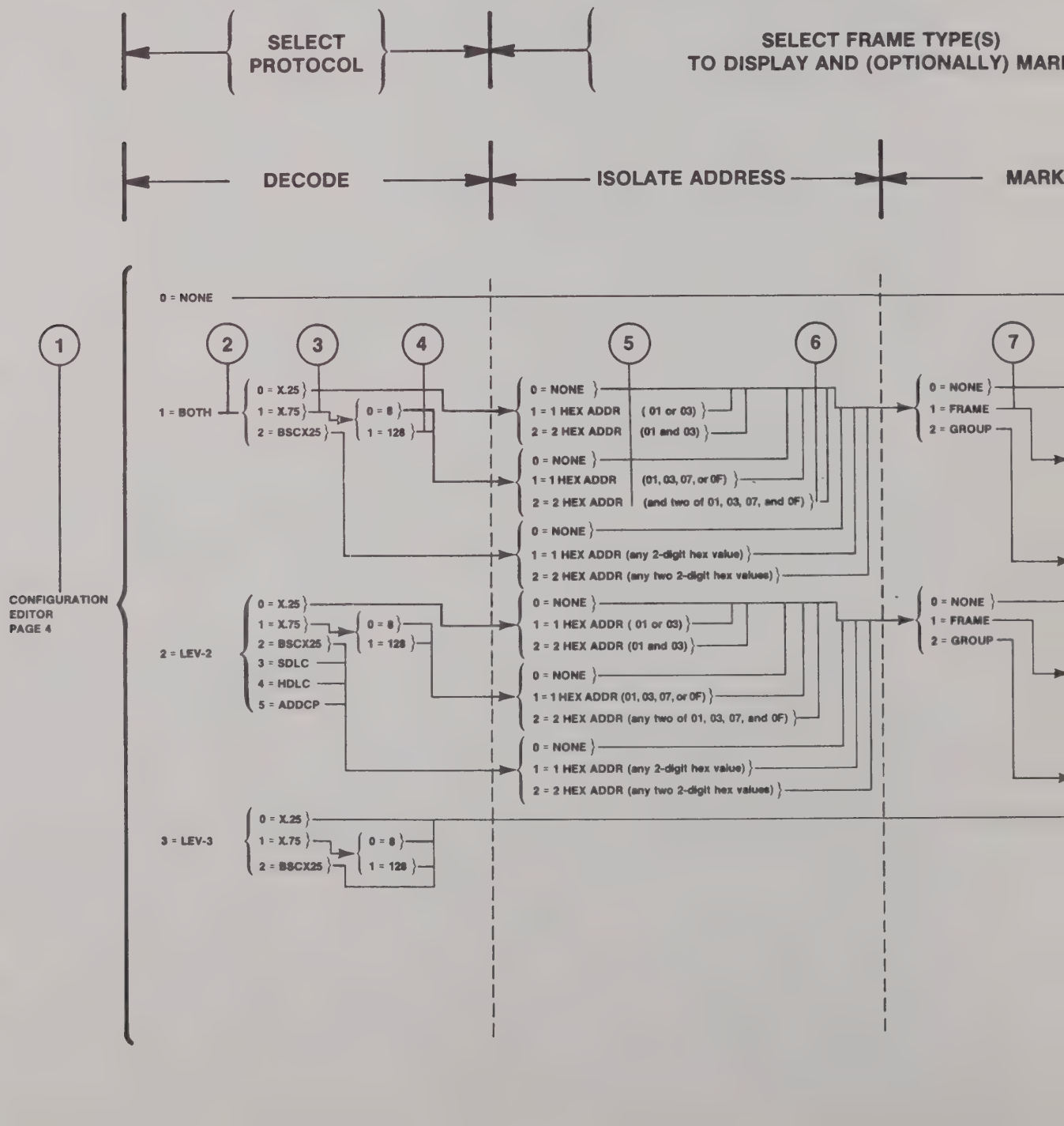
Since X.25, X.75, and Bisync X.25 use the same packet types, and since SDLC, HDLC, and ADDCP do not use packets at all, the single column of packet-decode illustrations is all that Table S4-2 needs. When you use Table S4-2 to interpret a decoded-packet display, use the "DECODED DISPLAY" column whether the current DECODE parameter (on page 4 of the configuration-editor display) is X.25, X.74, or Bisync X.25.

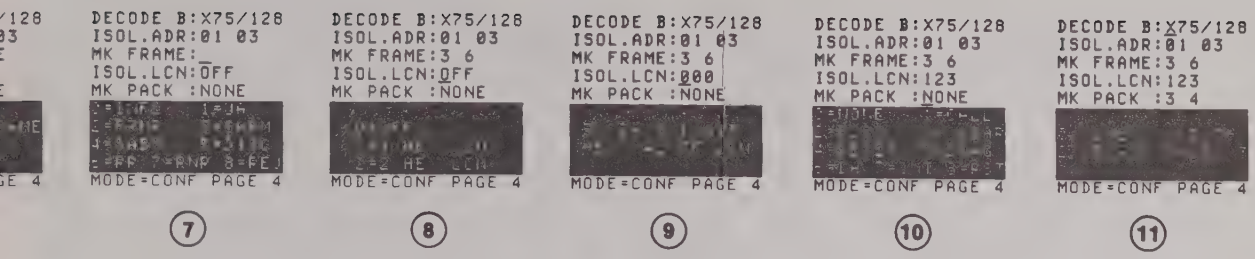
The information content in the first five columns of "ONLINE DATA" is shown as binary digits where practical. Where this is not practical, abbreviations replace the applicable bit fields. These abbreviations are defined in the box located to the left of the main body of the table.

For your additional convenience, octet 3 is also shown as a two-digit hex value (under the heading "HEX VALUE OF OCTET 3").

In addition, if an online packet has an octet 3 data content other than one of those defined in Table S4-2 it will be decoded as an invalid packet. Under these conditions, the CRT presents the message "*INVALID PACKET*" in the same place that a valid decode would have been presented.


DECODE :NONE
ISOL.ADR:OFF
MK FRAME:NONE
ISOL.LCN:OFF
MK PACK :NONE
MODE=CONF PAGE 4
1
DECODE B:X25
ISOL.ADR:OFF
MK FRAME:NONE
ISOL.LCN:OFF
MK PACK :NONE
MODE=CONF PAGE 4
2
DECODE B:X75/8
ISOL.ADR:OFF
MK FRAME:NONE
ISOL.LCN:OFF
MK PACK :NONE
MODE=CONF PAGE 4
3
DECODE B:X75/128
ISOL.ADR:OFF
MK FRAME:NONE
ISOL.LCN:OFF
MK PACK :NONE
MODE=CONF PAGE 4
4
DECODE B:X75/128
ISOL.ADR:OFF
MK FRAME:NONE
ISOL.LCN:OFF
MK PACK :NONE
MODE=CONF PAGE 4
5
DECODE B:X75/128
ISOL.ADR:OFF
MK FRAME:NONE
ISOL.LCN:OFF
MK PACK :NONE
MODE=CONF PAGE 4
6


SELECT PROTOCOL
SELECT FRAME TYPE(S) TO DISPLAY AND (OPTIONALLY) MARK
DECODE
ISOLATE ADDRESS
MARK
1
2
3
4
5
6
7
CONFIGURATION EDITOR PAGE 4
0 = NONE
1 = BOTH
0 = X.25
1 = X.75
2 = BSCX25
0 = 8
1 = 128
0 = NONE
1 = 1 HEX ADDR (01 or 03)
2 = 2 HEX ADDR (01 and 03)
0 = NONE
1 = 1 HEX ADDR (01, 03, 07, or 0F)
2 = 2 HEX ADDR (and two of 01, 03, 07, and 0F)
0 = NONE
1 = 1 HEX ADDR (any 2-digit hex value)
2 = 2 HEX ADDR (any two 2-digit hex values)
0 = NONE
1 = FRAME
2 = GROUP
2 = LEV-2
3 = SDLC
4 = HDLC
5 = ADDCP
3 = LEV-3



(7) (8) (9) (10) (11)

SELECT PACKET TYPE(S)
TO DISPLAY AND (OPTIONALLY) MARK

RAME

ISOLATE LOGICAL
CHANNEL (NUMBER)

MARK PACKET

DONE

8 9 10 11

0 = INFO
1 = UA
2 = FRMR
3 = SARM
4 = SABM
5 = DISC
6 = RR
7 = RNR
8 = REJ

SELECT 1 to 4 TYPES

0 = INFO
1 = SUPR
2 = UNN
3 = ERROR

SELECT 1 to 3 TYPES

0 = OFF
1 = 1 HEX LCN (any 3-digit hex value)
2 = 2 HEX LCN (any two 3-digit hex values)

0 = NONE
1 = CALL
2 = FLOW
3 = CLEAR
4 = RESET
5 = DIAG
6 = DA
7 = INT
8 = RST

SELECT 1 to 4 TYPES

DONE

PARAMETER IN EFFECT FOR MARK PACKET	MNEMONIC(S) ACTUALLY MARKED ON DATA DISPLAY
CALL	CALL CALL A
FLOW	RR RNR REJ
CLEAR	CLEAR CLEAR C
RESET	RESET RES C
DIAG	DIAG
DA	DATA
INT	INTER INT C
RST	RSTRT RST C

Figure S4-1. Configuration Editor Page 4 - Parameter Entry

Notes for Table S4-1, Frame Decodes

1 INFORMATION FRAMES

Information frames are used to transport information from an originating network, to a network entity at the end of a link. The information frame is identified by bit 0 of the control field set to 0. For Modulo 8, bits 1-3 represent the send sequence, N(S). Bit 4 is the Poll bit of command information frames and the Final bit of response information frames. Bits 5-7 represent the number of the next expected frame, N(R). For Modulo 128, bits 1 to 7 contain the N(S) count. Bit 8 contains the Poll/ Final bit and bits 9 to 15 contain the N(R) count. The first field is the hex value of the address field. The second field is the type field. Column 13 indicates whether the Poll/Final bit has been set (if set, then *). Column 15 is the hex value of the N(R) count.

2 SUPERVISORY FRAMES

Supervisory frames are used for flow control, recovery and acknowledgement of Information frames. The supervisory frame is identified by bits 0 and 1 of the control field being set to 1 0 respectively. Bits 2 and 3 represent the supervisory codes. In Modulo 8 bit 4 is used as Poll bit in command frames and as a Final bit in response frames. Bits 5 to 7 represent the N(R) count and are used for acknowledgement of Information frames and the indication of the next information frame to be received. For Modulo 128 bits 4 to 7 are not used. Bit 8 is the Poll/ Final bit. Bits 9 to 15 are the N(R) count. The first field is the hex value of the address field. The second field is the type field. Column 13 indicates whether the Poll/Final bit has been set (if set, then *; if not set, the N " "). Column 15 is the hex value of the N(R) count.

3 UNNUMBERED FRAMES

Unnumbered frames are used primarily for link establishment and control. Bits 0 and 1 of the control field are used to identify unnumbered frames. Bits 2, 3, 5, 6, and 7 identify the specific frame command or response. For Modulo 8, bit 4 is the Poll/ Final bit and is used for check-pointing. For Modulo 128, bit 9 is the Poll/Final bit.

4 CAN NOT DECODE

The D-101X frame decode (LEV-2) presents three types of error displays -- INVALID FRAME, BCC ERROR, and ABORTED. The cause of each error-display type is explained below. Note that the D-101X does not check the validity of N(R) and/or N(S) sequencing. Also note that the static display shows the actual online data stream in hex, ASCII, EBCDIC -- frames that caused error indications can be manually decoded (analyzed), if so desired.

FIELDS OF DISPLAYED FRAMES

A	Field	Description
	1	Address field in hex
	2	Frame type
	3	Send sequence number, N(S), in hex
	4	* = poll/final bit set, blank if not set
	5	Receive sequence number, N(R), in hex

B	Field	Description
	1	Address in hex
	2	Frame type
	3	* = poll/final bit set, blank if not set
	4	Receive sequence number, N(R), in hex

C	Field	Description
	1	Address in hex
	2	Frame type
	3	* = poll/final bit set, blank if not set

D	Field	Description
	1	Address in hex
	2	Frame type
	3	WXYZ = W, X, Y, and Z bits -- set if shown, not set if not shown
	4	* = poll/final bit set, blank if not set

E INVALID FRAME

If the DECODE/DISPLAY facility encounters a frame whose control field does not match one of those listed in Table S4-1, that frame is treated as faulty or unknown. That frame is shown on both the dynamic and the static display as INVALID FRAME.

F BCC ERROR

This message is displayed during both dynamic and static decoding of frames and/or packets if the block check character(s) (BCC) transmitted with the data fails to match the BCC calculated for that same data by the D-101X. When dealing with BSCX25, the equivalent of BCC is cyclic redundancy check (CRC). When dealing with X.25, X.75, SDLC, HDLC, and ADDCP, the equivalent of BCC is frame check sequence (FCS).

G ABORTED

This message is displayed during both dynamic and static decoding of frames and/or packets if, at any time during the decode, a series of seven or more 1's are detected. In many bit-oriented protocols, seven or more consecutive 1's are defined as an abort sequence.

ONLINE DATA				DE
Control Field 7 6 5 4 3 2 1 0	FRAME NAME	X.25	X.75	
	INFORM			
N(R) * N(S) 0	Information	01 INFO 01 * 02	01 INFO 01 * 02	
	SUPERV			
N(R) * 0 0 0 1	Receive Ready	01 RR * 01	01 RR * 01	
N(R) * 0 1 0 1	Receive Not Ready	03 RNR * 12	03 RNR * 12	
N(R) * 1 0 0 1	Reject	01 REJ * 1C	01 REJ * 1C	
N(R) * 1 1 0 1	Selective Reject	* 41		
	UNNUME			
0 0 0 * 0 0 1 1	Unnumbered Information Non Sequenced Information			
0 0 1 * 0 0 1 1	Unnumbered Poll Response Optional if No P Bit			
0 1 0 * 0 0 1 1	Disconnect Request Disconnect	01 DISC *	1 DISC *	
0 1 1 * 0 0 1 1	Unnumbered Acknowledge Non-Sequenced Acknowledge	03 UA *	03 UA *	
1 0 0 * 0 0 1 1	Set Normal Response Mode			
1 1 1 * 0 0 1 1	Check Pattern in I Field			
0 0 0 * 1 0 1 1	Non Reserved 0			
0 1 0 * 1 0 1 1	Non Reserved 1			
1 0 0 * 1 0 1 1	Non Reserved 2			
1 1 0 * 1 0 1 1	Non Reserved 3			
0 0 0 * 0 1 1 1	Set Initialization Mode Request Initialization Mode			
0 1 0 * 0 1 1 1	Remote Go-Ahead			
1 0 0 * 0 1 1 1	Frame Reject	03 FRMR WXYZ *	03 FRMR WXYZ *	
1 1 0 * 0 1 1 1	Configure			
0 0 0 * 1 1 1 1	Station Off-Line Disconnected Mode		03 DM *	
	Set Async Response Mode/Disconnected Mode Request Off-line	03 DM/SARM *	03 DM/SARM *	
0 0 1 * 1 1 1 1	Set Async Balanced Mode	03 SABM *	03 SABM *	
0 1 0 * 1 1 1 1	Set Async Response Mode Extended			
0 1 1 * 1 1 1 1	Set Async Balanced Mode Extended		01 SABME *	
1 0 0 0 1 1 1 1	Reset			
1 0 1 * 1 1 1 1	Exchange Identification			
1 1 0 * 1 1 1 1	Set Normal Response Mode Extended			
1 1 1 * 1 1 1 1	Beacon			
	CAN NO			
NONE ABOVE	FAULTY OR UNKNOWN	*INVALID FRAME*	*INVALID FRAME*	
NONE ABOVE	FAULTY OR UNKNOWN	*BCC ERROR*	*BCC ERROR*	
NONE ABOVE	FAULTY OR UNKNOWN	*ABORTED*	*ABORTED*	

CODED DISPLAY (PER PROTOCOL)

BSCX25	SDLC	HDLC	ADDCP	KEY TO NOTES
ATION FRAME				1
INFO 01 * 02	01 INFO 01 * 02	01 INFO 01 * 02	01 INFO 01 * 02	A
SORY FRAMES				2
RR * 01	01 RR * 01	01 RR * 01	01 RR * 01	B
RNR * 12	03 RNR * 12	03 RNR * 12	03 RNR * 12	B
REJ * 1C	01 REJ * 1C	01 REJ * 1C	01 REJ * 1C	B
		01 SREJ * 41	01 SREJ * 41	B
ERED FRAMES				3
		03 UI *	03 UI *	C
	01 NSI *			C
		03 UP *	03 UP *	C
	01 NSP *			C
DISC *	01 DISC *			C
		01 DISC/RD *	01 DISC/RD *	C
UA *		03 UA *	03 UA *	C
	03 NSA *			C
	03 SNRM *	03 SNRM *	03 SNRM *	C
	01 TEST *			C
		01 NRO *	01 NRO *	C
		01 NR1 *	01 NR1 *	C
		01 NR2 *	02 NR2 *	C
		03 NR3 *	03 NR3 *	C
	01 SIM/RIM *	01 SIM/RIM *	01 SIM/RIM *	C
	01 SIM/RIM *	01 SIM/RIM *	01 SIM/RIM *	C
	01 RGA *			C
FRMR WXYZ *	03 FRMR WXYZ *	03 FRMR WXYZ *	03 FRMR WXYZ *	D
	03 CFGR *			C
				C
DM/SARM *		03 DM/SARM *	03 DM/SARM *	C
	01 ROL *			C
SABM *		01 SABM *	01 SABM *	C
	01 SARME *	01 SARME *	01 SARME *	C
		03 SABME *	03 SABME *	C
		03 RSET *	03 RSET *	C
	03 XID *	03 XID *	03 XID *	C
		01 SNRME *	01 SNRME *	C
	01 BCN *			C
DECODE				4
NVALID FRAME* *BCC ERROR* *ABORTED*	*INVALID FRAME* *BCC ERROR* *ABORTED*	*INVALID FRAME* *BCC ERROR* *ABORTED*	*INVALID FRAME* *BCC ERROR* *ABORTED*	E F G

Notes for Table S4-2, Packet Decodes

FIELDS OF DISPLAYED PACKETS

A	Field	Description
	1	First digit is not used. It is always zero. Second digit shows logical channel group number, LCGN, in hex. Last two digits show logical channel number, LCN, in hex.
	2	Packet type

B	Field	Description
	1	First digit is not used. It is always zero. Second digit shows logical channel group number, LCGN, in hex. Last two digits show logical channel number, LCN, in hex.
	2	Packet type
	3	Clearing clause (in hex)

C	Field	Description
	1	First digit is not used. It is always zero. Second digit shows logical channel group number, LCGN, in hex. Last two digits show logical channel number, LCN, in hex.
	2	Packet type
	3	First two digits show packet receive sequence, P(R), in hex. Last two digits show packet sent sequence, P(S), in hex.
	4	DMQ = D, M, and Q bits -- set if shown, not set if not shown.

D	Field	Description
	1	First digit is not used. It is always zero. Second digit shows logical channel group number, LCGN, in hex. Last two digits shows logical channel number, LCN, in hex.
	2	Packet type
	3	Packet receive sequence, P(R), in hex

E	Field	Description
	1	First digit is not used. It is always zero. Second digit shows logical channel group number, LCGN, in hex. Last two digits show logical channel number, LCN, in hex.
	2	Packet Type
	3	First two digits show resetting clause (in hex). Last two digits show diagnostic code (in hex).

F	Field	Description
	1	Packet type
	2	First digit is not used. It is always zero. Second digit shows logical channel group number, LCGN, in hex. Last two digits show logical channel number, LCN, in hex.

G	Field	Description
	1	Packet type
	2	First digit is not used. It is always zero. Second digit shows logical channel group number, LCGN, in hex. Last two digits show logical channel number, LCN, in hex.

H INVALID PACKET

If the DECODE/DISPLAY facility encounters a packet whose control field does not match one of those listed in Table S4-2, that packet is treated as faulty or unknown. That packet is shown on both the dynamic and the static display as INVALID PACKET.

Note that the D-101X decodes and displays a maximum of one packet per frame. If you are working with a nonstandard protocol wherein a frame may contain more than one packet, you can use the static decode to locate the frame of interest; then analyze the hex, ASCII, or EBCDIC display of that frame. The entire frame and the packet(s) it contains will appear in the static decode of the frame.

I BCC ERROR

This message is displayed during both dynamic and static decoding of frames and/or packets if the block check character(s) (BCC) transmitted with the data fails to match the BCC calculated for that same data by the D-101X. When dealing with BSCX25, the equivalent of BCC is cyclic redundancy check (CRC). When dealing with X.25, X.75, SDLC, HDLC, and ADDCP, the equivalent of BCC is frame check sequence (FCS).

J ABORTED

This message is displayed during both dynamic and static decoding of frames and/or packets if, at any time during the decode, a series of seven or more 1's are detected. In many bit-oriented protocols, seven or more consecutive 1's are defined as an abort sequence.

ABBREVIATION
LIST

CLCL = Clearing Clause

DIACD = Diagnostic Code

DIAEXP = Diagnostic Explaination
(Length Variable)

GFI = General Format
Identifier

IUSER = Interrupt User Data
(Length Variable)

LCGN = Logical Channel
Group Number

LCN = Logical Channel Number

RESCL = Resetting Clause

RSTCL = Restarting Clause

USER = User Data
(Length Variable)

OCTET 1	OCTET 2	OC
BIT	BIT	B
7 6 5 4 3 2 1 0	7 6 5 4 3 2 1 0	7 6 5
X--GFI--X--LCGN-X	X------LCN------X	0 0 0
X--GFI--X--LCGN-X	X------LCN------X	0 0 0
X--GFI--X--LCGN-X	X------LCN------X	0 0 0
X--GFI--X--LCGN-X	X------LCN------X	0 0 0
X--GFI--X--LCGN-X	X------LCN------X	P(R)
X--GFI--X--LCGN-X	X------LCN------X	X-----P
X--GFI--X--LCGN-X	X------LCN------X	0 0 1
X--GFI--X--LCGN-X	X------LCN------X	0 0 1
X--GFI--X--LCGN-X	X------LCN------X	P(R)
X--GFI--X--LCGN-X	X------LCN------X	0 0 0
X--GFI--X--LCGN-X	X------LCN------X	P(R)
X--GFI--X--LCGN-X	X------LCN------X	0 0 0
X--GFI--X--LCGN-X	X------LCN------X	P(R)
X--GFI--X--LCGN-X	X------LCN------X	0 0 0
X--GFI--X--LCGN-X	X------LCN------X	0 0 0
X--GFI--X--LCGN-X	X------LCN------X	0 0 0
X--GFI--X0 0 0 0	0 0 0 0 0 0 0 0	1 1 1
X--GFI--X0 0 0 0	0 0 0 0 0 0 0 0	1 1 1
X--GFI--X0 0 0 0	0 0 0 0 0 0 0 0	1 1 1
		NONE
		ANY OR N
		ANY OR N

ONLINE DATA

ET 3	OCTET 4	OCTET 5	HEX VALUE OF OCTET 3	PACKET NAME	DECODED DISPLAY	KEY TO NOTES
	BIT	BIT				
3 2 1 0	7 6 5 4 3 2 1 0	7 6 5 4 3 2 1 0				

CALL SET-UP AND CLEARING

1 0 1 1	X----------NU----------X	0B	Call Request	0001 CALL	A
1 1 1 1	X----------NU----------X	0F	Call Connected	0021 CAL A	A
0 0 1 1	X------CLCL-----XX-------NU-------X	13	Clear Request	0012 CLEAR A3	B
0 1 1 1	X----------NU----------X	17	Clear Confirmation	0034 CLR C	A

DATA AND INTERRUPT

P(S) 0	X------USER-----XX------USER------X	EVEN NO.	Data (Modulo 8)	0023 DATA 0103 DMQ	C
)----X0	X------P(R)---XMXX------USER------X	EVEN NO.	Data (Modulo 128)	0023 DATA 0103 DMQ	C
0 0 1 1	X------USER-----XX------USER------X	23	Interrupt	0001 INTER	A
0 1 1 1	X----------NU----------X	27	Interrupt Confirmation	0003 INT C	A

FLOW CONTROL AND RESET

0 0 0 1	X----------NU----------X	X1	Receive Ready (Modulo 8)	0002 RR 01	D
1 0 0 1	X------P(R)---XOXX-------NU-------X	09	Reject (Modulo 8)	0003 REJ 1D	D
0 1 0 1	X----------NU----------X	X5	Receive Not Ready (Modulo 8)	0003 RNR 06	D
0 1 0 1	X------P(R)---XOXX-------NU-------X	05	Receive Not Ready (Modulo 128)	0003 RNR 06	D
1 0 0 1	X----------NU----------X	X9	Reject (Modulo 8)	0003 REJ 1D	D
0 0 0 1	X------P(R)---XOXX-------NU-------X	01	Receive Ready (Modulo 128)	0002 RR 01	D
1 0 1 1	X-----RESCL-----XX-----DIACD------X	1B	Reset Request	0002 RESET 0145	E
1 1 1 1	X----------NU----------X	1F	Reset Confirmation	0023 RES C	A

RESTART

1 0 1 1	X-----RSTCL-----XX-----DIACD------X	FB	Restart	RSTRT 2104	F
1 1 1 1	X----------NU----------X	FF	Restart Confirmation	0008 RST C	A

DIAGNOSTIC

0 0 0 1	X-----DIACD-----XX-----DIAEXC-----X	F1	Diagnostic Request	DIAG 0F0137BD	G

CAN NOT DECODE

BOVE		FAULTY OR UNKNOWN	*INVALID PACKET*	H
NE ABOVE		FAULTY OR UNKNOWN	*BCC ERROR*	I
NE ABOVE		FAULTY OR UNKNOWN	*ABORTED*	J

MP MASTER
MA23767